Coordination Action in R&D in Accessible and Assistive ICT

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CARDIAC

Coordination Action in R&D in Accessible and Assistive ICT

FP7 – Coordination Action

Deliverable D1.2:

Production of Accessible & Assistive ICT Systems and Materials

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Background

The market for Accessible ICT and Assistive ICT products and services is complex and presents many challenges for successful technology transfer. It includes an array of supply and sale mechanisms, from direct sales to consumers to indirect supply in specialised fields such as Assistive Technology.

The ultimate determinant of successful research & development in the area of Accessible and Assistive ICT must be whether or not a product or service reaches the market place and is available to consumers throughout the EU.

It is clear however, that much good research fails to result in new innovations transferring successfully to the market place. Consequently in such instances, it may be argued that consumers do not benefit directly from investment in research. There are a variety of reasons why this is so, some of these are specific to the area in question, such as the complex supply chain in many countries, others however are more applicable to the transfer of ICT products in general, such as affordability, availability etc.

University researchers need to promote research results with the public and private sector to better convey the use and benefits of research and more importantly help build trust between the university and agency to enhance speed up of the adoption of innovation.

Executive Summary

This report is deliverable D1.2 “Production of Accessible & Assistive ICT Systems and Materials” and summarises the work and results of Task 1.1.

The *analytical part* of the report describes**;**

- the analysis of the markets of Accessible and Assistive ICT including the suppliers, the service delivery and the consumers of such products and services, (chapter 2);
- the analysis of organisational and procedural processes in technology transfer in Accessible and Assistive ICT, including the analysis of success factors and failures (chapter 3), and concluding with suggestions for best practice in technology transfer (chapter 7.2).

These investigations, the results of the first SDDP workshop in Cyprus in 2010 (Annex 8.1), results of the second SDDP workshop at San Sebastian in 2011 (Annex 8.2), and findings from the survey conducted of ICT companies in 2012 (Annex 8.3), form the basis for the *constructive part* of the report, comprising:

- the development of a structured methodology to elaborate a roadmap for supportive actions in technology transfer in the area of Accessible and Assistive ICT, (chapters 4.1-4.2);
- the further development of the findings of the SDDP workshop, i.e. the distinction of the ideas with respect to relevance to Accessible ICT and/or to Assistive ICT and the corresponding split of the influence tree (Annex 8.1);
- the first steps of the elaboration of the roadmap, including vision building (chapter 4.3), gap analysis (4.4), identification of activities’ (4.5), and dependency analysis of the most relevant activities (4.6);
- a first part of a roadmap to support technology transfer, including the description of 7 strategic supportive actions each for technology transfer in Accessible ICT and in Assistive ICT, including a summary of activities of the involved stakeholders and of potential support by the European Commission (chapter 5).

The results of the first steps of roadmapping are set in relation to intermediate findings of the on-going in-depth analysis in Task 1.4 of the “Smart Living” area (chapter 6).

This report aims to form a key part of the overall CARDIAC objective of researching agenda roadmaps that highlight research priorities that will favour Accessible and Assistive ICT in the future and will form a basis for continuing discussion on how to improve technology transfer going forward.

Deliverable D1.2 in the Context of WP1

Overall goal of WP1

The **overall goal of Work Package 1 "Technology Transfer – How to achieve accessibility"** is to study market factors and economic requirements relating to the development of Accessible and Assistive ICT products and systems by designers and manufacturers, helping them to incorporate the necessary features at a reasonable cost, whilst dealing with the unavoidable complexity of the industrial value chain and remaining profitable.

Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services.

Objectives of WP1 (and related tasks)

- To identify the **main factors** that influence how accessible and Assistive ICT products are sold to consumers, in complex supply markets. (**T1.1**)
- To study **organisational means and procedures** – intra and inter – ICT developing companies and other related organisations to achieve accessibility of their products and services, including the analysis of industrial practice and the description of best practice. (**T1.1**)
- To study the advancements in **solutions for supporting developers** in embedding generalised accessibility support within mainstream ICT-based products and services. (**T1.2**)
- To identify the **existing supports for manufacturers or designers** in bringing a proposed product or service, successfully to market. (**T1.5**)
- To propose a **short/medium/long term set of objectives** for the development and application of systems and services supporting accessibility as well as for the implementation of accessibility supporting means in and between companies/ organisations. (**T1.5**)
- To create a **road-map** that supports future EU research and industry alike in ensuring better uptake of technology, knowledge and skills. (**T1.5**)

Deliverables of WP1 (and contributing tasks)

- **D1.1** "Report with background material needed to support the SDDP-1 meeting". **(T1.1)** [month 8 - done]
- **D1.2** – Advanced Draft "Production of Accessible and Assistive ICT systems & materials". **(T1.1/T1.4)** [month 20 - done]
- **D1.2** "Production of Accessible and Assistive ICT systems & materials". **(T1.1/T1.4)** [Review 2012] – D1.2 aims primarily at the industrial and research community. It will

help manufacturers, researchers and designers to take a broad look at technology transfer for the production of Accessible and Assistive ICT systems and materials. It will outline factors for success based on the analysis of previous work and on examples of best practice.

- **Draft Umbrella Report** combining intermediate outcomes of WP1 and WP3 [Review 2012]
- **D1.3** Available systems and services supporting developers to achieve accessibility. **(T1.2/T1.5)** [month 36] – D1.3 will describe available systems and services supporting developers to achieve accessibility; it will identify research and development areas which could benefit from such systems and services; it will also contain a directory of useful support for Accessible and Assistive ICT producers interested in successful technology transfer; it will identify gaps in available systems/services, and needs and requirements for closing those gaps; suggesting tasks for R&D in the area of accessibility supporting systems/services/methodologies.

Tasks of WP1 (and related deliverables)

T1.3 – Formulate **triggering question** for WP2 / SDDP-1 – [done]

T1.1 – Analyse **technology transfer in Accessible/Assistive ICT**

Study organisational and procedural processes

-> **D1.1** (background material for SDDP-1) – [done]

-> T5.2 / **D5.2** (Public report on TT) – [done in WP5]

-> **D1.2 – Advanced Draft** including **Draft roadmap** – [done]

-> **D1.2** (analysis of processes and success criteria) – [done]

T1.4 – Analyse the **Smart Living** area

-> essentials regarding technology transfer described in **D1.2** – [done]

-> separate report on Smart Living Area analysis [in progress]

T1.2 – Study of **guidelines, standards, solutions, models, …**

-> **D1.3** – [month 36]

T1.5 – Identification of **existing technology transfer supports**

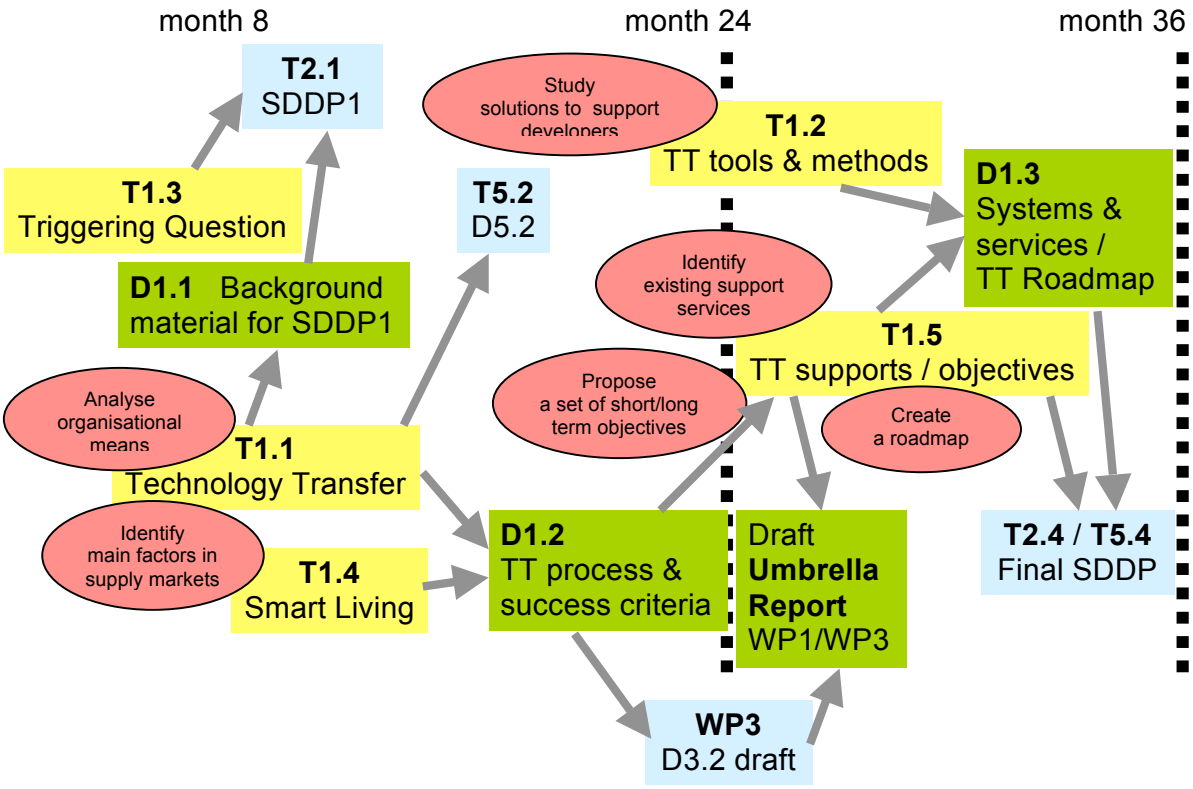
short, medium & long-term objectives / **roadmap**

-> **Draft Umbrella Report of WP1 and WP3** – [review 2012]

-> T2.4 / T5.4 / **D2.4** – [Final SDDP workshop]

-> **D1.3** – [month 36]

Relations and dependencies between objectives – tasks – deliverables of WP1 and other WPs



Contributing tasks to this Deliverable D1.2

The **first task, T1.1**, of this Workpackage is to analyse the success or failure of the transfer of technology in the area of ICT and assistive technology. Even some of the more successful research proposals and R&D in this area have not had the expected impact. It is important to analyse why this is the case and what new approaches could be used to improve the transfer process. Defining criteria for success and analysing indicative factors on a continuum of success/failure are the focus of this work.

Furthermore a detailed study of organisational and procedural processes – intra and inter – that ICT development companies and other related organisations exploit to achieve accessibility of their products and services is conducted in conjunction with an analysis and description of best practice examples. The outcome of this work provides the basis for defining a best practice methodology for successful technology transfer. The core outcomes of this work will form the content for Deliverable 1.2.

The **fourth task T1.4** will involve the analysis of “sample areas” within the Assistive and Accessible ICT fields, specifically that of ‘Smart living’. A thorough review of the development that lead to current market ready Smart Home Technology available in the European market place, with a view to defining the successes and failures of achieving technology transfer. The results of this work will be presented in D1.2 and in detail in a separate report.

Contributing tasks to Deliverable D1.3

The **second task, T1.2,** will involve conducting a state-of-the art study about solutions (methods, models, guidelines, standards, tools, ...) that support developers of mainstream ICT-based products and services to realise accessibility of such systems. Review of the advancements in the field of virtual environments and user modelling will be presented as an exemplar for this analysis. – The study will mainly be done as a desktop research.

The **fifth task, T1.5,** will involve the identification and mapping of existing technology transfer supports, institutional and commercial available throughout the EU as well as the definition of a common set of short, medium and long-term objectives for the development and application of systems and services supporting accessibility.

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D2.1 “Technology Transfer Influence Tree for WP1”

D2.2 “Influence Tree on inclusive HCI research and development priorities for WP3”

D3.2 “Trends on Inclusive User Interface Design”

D5.2 “Technology Transfer for Assistive and Accessible ICT Systems”

Acronyms and Abbreviations

AT	Assistive Technology
DfA	Design for All
EC	European Commission
EU	European Union
ICT	Information & Communication Technologies
PC	Personal Computer
SDDP	Structured Dialogic Design Process
TT	Technology Transfer
UD	Universal Design
UN	United Nations
VF	Vision Facet
WP	Workpackage

1. Introduction

The world of technology continues to change and develop at such a fast rate bringing new and exciting opportunities for everyone to participate in society. However, for people with disabilities this can be a real challenge. All too often they have to depend on adapted services or products where prices are high and choice is limited. In an ideal world, all goods and services should be accessible to all, regardless of disability.

Given the complexity of the market (regulations, business models, language etc), this report analyses the market in detail using a number of tools with a view to making recommendations that will tie in with the forthcoming deliverable and ultimately, deliver the final roadmap.

Key sources of data in this report have been collected from a detailed analysis of the Structured Dialogic Design Process where a number of experts were invited to participate, in line with an industry survey on technology transfer to mainstream ICT companies as well as a detailed independent living study. . All information has been checked and reviewed.

This report will be play a key role in producing the final inclusive roadmap.

Technology development is accelerating and technological devices are commonplace in the daily life, work places, health care, and education.

Assistive Technology (AT) is technology used by individuals with disabilities in order to perform functions that might otherwise be difficult or impossible. In this sense, AT helps to compensate disabilities of an individual person or helps to overcome barriers in the environment of a person with disabilities. Assistive technology can include mobility devices such as walkers and wheelchairs, as well as hardware, software, and peripherals that assist people with disabilities in accessing computers or other information technologies. The provision of Assistive Technology as a service has been available since the 1930s, with specialised equipment and devices for people with disabilities. With the advent of computers, technology entered the lives of many people and now represents one of the few areas in which the interests of people with disabilities and able-bodied people intersect [Mendelsohn 2002].

Universal Design / **Design for All (DfA)** "Universal design" means the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. “Universal design” shall not exclude assistive devices for particular groups of persons with disabilities where this is needed. [Article 2 UN Convention, Council of Europe 2009 Achieving Full Participation through Universal Design]

Changing demographics across Europe are forging changes upon the European Market, and this is having an impact in all areas of Accessible and Assistive ICT. It is public policy and legislation that is being increasingly used to ensure accessibility, and thereby improving the lives of people with disabilities.

It is proposed in Europe that legislation should cover accessibility of goods and services purchased through public procurement as is the case in the USA to ensure that all public procurement purchases of goods and services must be accessible. The Disability Act in Ireland binds accessibility closely to work on standardisation to determine what makes something accessible (i.e., Universal Design).

Assistive Technology in the area of Information and Communication Technologies (AT ICT) is defined in Class 22 of ISO 9999:2007 as “Assistive products for communication and information”. **Assistive ICT** products and services are understood to be devices or services for helping a person with disabilities to receive, send, produce and/or process information in different forms. Included are, e.g., devices for seeing, hearing, reading, writing, telephoning, signalling and alarming, and information technology. The use of Assistive ICTs within these categories depends on the specific needs of an individual and the particular environment in which they will be used. In practice the use will overlap as Assistive ICTs can be used in each of the environments that are subject of this study.

There are two elements in the area of Assistive ICT, hardware and software. Examples of accessible hardware: Alternative mouse/pointing devices, alternative keyboards switches, eye tracking devices, voice recognition systems, brain computer interface systems, environmental control devices etc

It is in the area of environmental control that it is considered assistive technology plays an essential role in determining **independent living**. It has been determined that the cost of caring for older adults will escalate sharply in less than a decade. There is increasing pressure to develop a more effective and less costly model of delivering services to older people as well as people with disabilities. In research conducted through the Intel Corporation (2005) one of the leading suppliers of ICT, it was suggested that the solution should include three components:

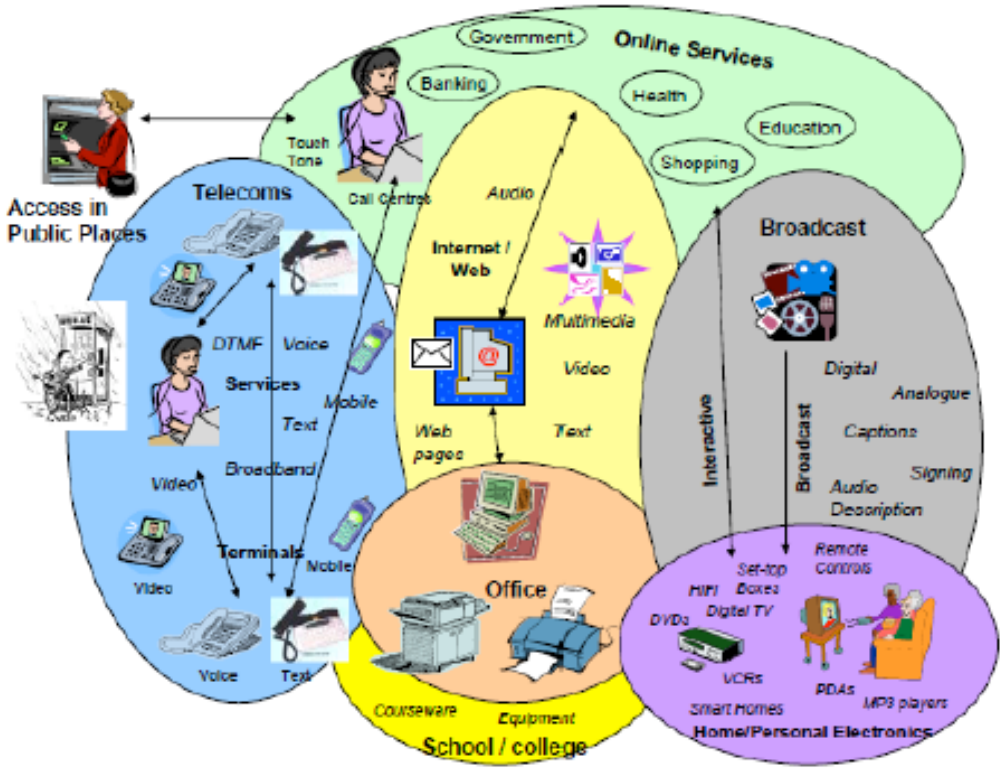
- an emphasis on prevention rather than treatment;
- a shift in the focus of care from expensive clinical settings to the home;
- This solution can be enabled by a range of proactive computing technologies in the digital home.

Software developments can range from that developed to make a specific AT product (Braille display) work with traditional non-AT products (a PC), as well as software 100% dedicated for specific AT use, such as environmental control systems based on software which enabled a quadriplegic person to control his / her environment using only voice commands. Examples of assistive software are voice recognition, word prediction, alternative and augmentative communication, screen readers, speech synthesizers, spellcheckers etc.

In line with technology advancements, there has also been an enormous increase in the number of products available in Assistive Technology. The market is large, one of the largest databases ABLEDATA in the US lists 40,000 products in twenty categories, with a thousand new products each year, and the market is growing globally. In Europe, making mainstream

ICT products and services accessible for all is referred to as **e-Accessibility**. e-Accessibility is a measurement of how usable 'interactive products' are to users with disabilities.

The accessibility of key mainstream ICT domains was measured in the MeAC study in a benchmarking exercise for 2007-2008. There is a broad spectrum of ICTs that are relevant to the field of e-Accessibility. The main conclusion from this is that a notable lack of e-Accessibility is observed in this domains.[11] Hence, the need for Assistive ICT is apparent.



source: MeAC (2007)

Figure 1: Spectrum of relevant ICT products and services

There are currently approximately 45 million people in Europe who report a long standing health problem or disability (1. Demographic changes across Europe show that people aged 65 years or over in the total population are projected to increase from 17.1% to 30.0% and the number is projected to rise from 84.6 million in 2008 to 151.5 million in 2060). Increasingly, it is the older population that are using Assistive Technology devices. Research in Sweden found that 70% of assistive devices prescribed go to people aged over 65. These demographic shifts are going to be an important driver behind increases in demand, as well as increases, or changes in the types of demands for more accessible products, including some forms of assistive technology.

[1] "Situation of disabled people in the enlarged European Union: the European Action Plan 2006-2007"
http://ec.europa.eu/employment_social/index/com_2005_604_en.pdf, page 4.

Accessible ICT

Competition among countries to attract multinational companies in all areas of ICT activities has increased substantially during the last years. Although the strategies are not specific to accessibility there is a growing awareness of the importance of accessibility particularly in relation to our aging population. The European Commission has stated that eAccessibility is “a social, ethical and political imperative” as well as having a high economic and market importance. At a global level the UN Convention on the Rights of people specifically include e-Accessibility “to promote access for persons with disabilities to new information and communications technologies and systems, including the internet”.

It is now widely accepted that advancement in the accessibility of ICT products and services can be beneficial to everyone, firstly through the model of universal design and secondly by making ICTs more usable in general. It is considered that facilitating people with disabilities or older people will also facilitate general use, e.g. hands free phones and mobiles or accessible public information systems. Increasingly public policy is enforcing accessibility in the build environment and product design, thereby improving the lives of people with disabilities but also facilitating general public use. Most mainstream ICT products do afford accessibility options, e.g. font and colour settings – changing the fonts used within applications can be useful to people with such vision impairments, as well as to people with dyslexia.

Both Windows and Apple operating systems also provide magnification options including lens mode and full-screen mode. On-screen keyboards can be personalized and resized to make it easier to see. Text prediction, speech recognition and touch technology are now common accessibility options.

At both European and national level the preferred method of ensuring accessibility of all products including ICT is through Universal Design, it is more cost effective when products are designed to include a broad range of users. By including consideration for accessibility in the design considerations from the outset of the development of the product or service mainstream products can be made more accessible.

However, there is some concern in the industry that accessibility standards, while essential, must not hamper creativity or innovation. It is at this juncture that it is considered that assistive technology can bridge the gap. Basically, it is expected that the industry will provide accessible solutions at the design phase, but where this is not possible for reasons of design or cost or time, assistive technology devices can be used to ensure inclusion.

An important element is the involvement of the end user at all stages of the design process, not simply at the end. In addition, the importance of accessibility requirements for public procurement cannot be overlooked. The mere size of the public procurement in Europe, about 16% of the gross domestic product, shows that it has an important role to play in shaping the demand for more accessible products; however issues at local level with both standards and procurement are precluding a mass market.

A key factor affecting the industry in Accessible ICT is the issue of standardisation, the level of accessibility within the product. The European Standardisation, the Committee for Standardisation (CEN), the European Telecommunications Standards Institute (ETSI) and the European Committee for Electro technical Standardisation (CENELEC) (jointly organised in the ICT Standards Board (ICTSB), are currently working on the mandate 376 to enable the use of public procurement and practice for ICTs to remove barriers to participation in the Information Society by disabled and older people. (eAccessibility under mandate M/376, “Online Procurement Toolkit for Accessible ICT products and services)

In December 2005, the mandate was given by the European Commission to the European Standards Organisations (ESOs) to come up with a solution for common requirements and conformance assessment. The Council of Europe Disability Action Plan 2006-2015, advocates Universal Design as a means of accomplishing the goals set in the Action Plan. From an industry perspective the International Organization for Standardisation has contributed with Universal Design and Accessible Design guides on the requirements of groups of disabled citizens. The guides assist industry in translating the basic values into products and environments that in fact are more usable for more citizens, regardless of age or disabilities.

The potential offered by ICT is enormous with the benefit of solving issues in complex tasks and services, increased convergence, connectivity and interoperability between communication networks, personal computing, the Internet, and ever-smarter mobile devices and services offer enormous potential for improving life.

An EU communication “Towards an accessible information society”, adopted by the Council on 31 March 2009, stressed the promotion of e-Accessibility", assistive technology and usability the European Commission could ensure that people with disabilities and elderly people can access ICTs on an equal basis with others. Removing barriers encountered in relation to access and use of ICT products, services and applications is an important aspect when it comes to the working environment, improved independent living or learning. In addition there are strong economic benefits associated to improving the employability and independence of the elder or disabled.

2. The Market of Accessible ICT & Assistive ICT

2.1. The consumers

Table 1 shows the population between 15 and 79 years old, distributed by country, that is restricted ("considerably restricted" and "restricted to some extent") or elderly (between 65 and 79), and compares it to the total population. The data exposed in this paragraph was inferred from [Eurostat, 2002], [Applica et al., 2007], [World Health Organization, n.d.], [European Commission, n.d.].

Table 1: Elderly and people with restrictions in EU countries

	Individuals restricted between 15 - 79	Individuals restricted between 15 - 64, and all elderly population between 65- 79	Total population between 15 - 79	Total population
Belgium	722.973	1.912.357	8.261.946	10.511.382
Czech Republic	1.495.561	2.290.932	8.426.387	10.251.079
Denmark	668.066	1.130.746	4.195.426	5.427.459
Germany (including former GDR from 1991)	7.898.467	17.634.724	67.186.966	82.437.995
Estonia	150.931	288.714	1.098.607	1.344.684
Ireland	299.640	590.972	3.236.736	4.209.019
Greece	683.631	2.120.815	9.133.772	11.125.179
Spain	3.286.726	7.716.330	35.531.699	43.758.250
France	8.060.630	13.446.521	48.446.056	62.998.773
Italy	3.214.247	10.796.978	47.412.631	58.751.711
Cyprus	73.066	127.747	604.701	766.414
Lithuania	280.676	620.391	2.743.047	3.403.284
Luxembourg	20.169	66.271	367.294	469.086
Hungary	1.198.136	2.130.179	8.172.107	10.076.581
Malta	26.429	64.002	323.195	405.006
Netherlands	1.938.871	3.293.385	12.773.352	16.334.210
Austria	649.192	1.471.180	6.578.676	8.254.298
Portugal	1.773.726	2.655.483	8.497.952	10.569.592
Slovenia	365.280	521.286	1.656.777	2.003.358
Slovakia	426.694	837.171	4.365.236	5.389.180
Finland	1.087.448	1.453.236	4.141.397	5.255.580
Sweden	767.005	1.689.722	6.993.912	9.047.752
United Kingdom	8.324.487	13.411.968	46.998.916	60.409.918

	Individuals restricted between 15 - 79	Individuals restricted between 15 - 64, and all elderly population between 65- 79	Total population between 15 - 79	Total population
Romania	1.121.332	3.473.712	17.698.764	21.610.213
Norway	572.752	915.812	3.521.926	4.640.219
EU	**45.106.133**	**90.660.635**	**358.367.478**	**449.450.222**

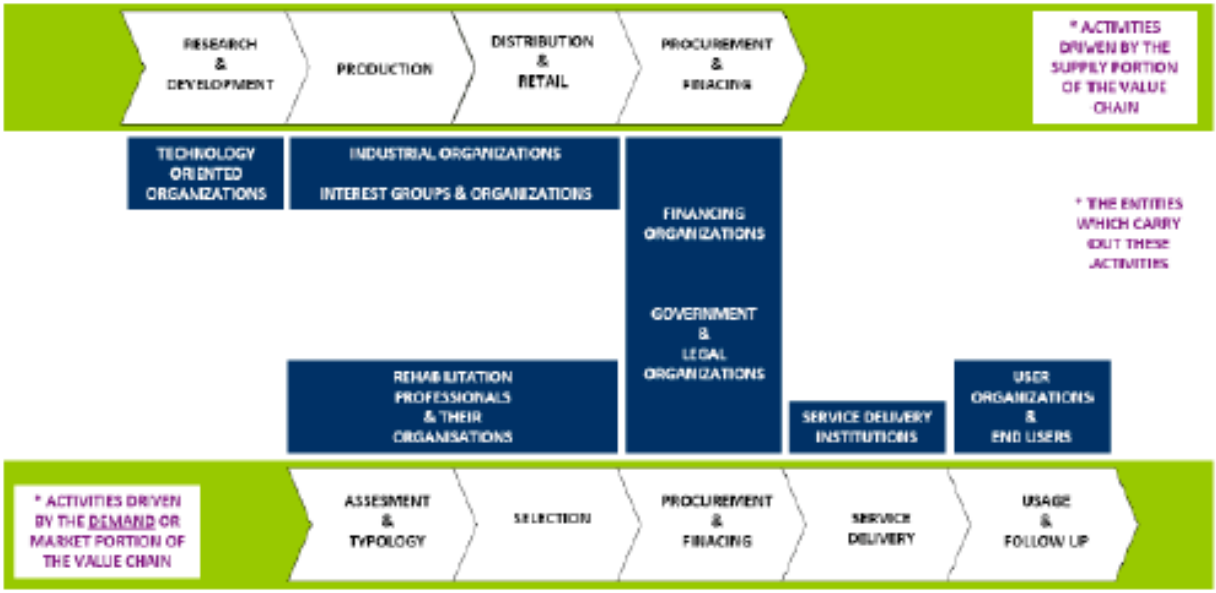
[Source: data inferred from (Eurostat 2006) and (Applica et al, 2007) (Ref: ATIS4ALL)]

Difficulties in the ICT market for users are also analysed in Monitoring eAccessibility in Europe, 2011 a study led by Technosite. [MeAC2] The study reports that following the Riga Declaration where it was stressed that there was an urgent need to ensure accessibility and usability of ICT products and services. The declaration further urged for digital inclusion in all areas of policy making and it was expected that a platform would emerge for the development of accessible technologies in European states. However the report, 5 years later shows that no significant advances were made and following the report of 2007 which showed that disabled people in Europe still face many barriers regarding the use of everyday ICT products and services, these results are further ratified by the present report.

2.2. Service delivery

Although legislation and policy both at European and National level has determined that disability and matter relating should be determined through a social model which sees the problem as being located within the attitudes of society and an inaccessible environment, it is however at the service provision level AT is still located in an medicalised and hierarchic model. While AT remains within a medical remit, AT devices are characteristically more expensive and less likely to be mainstreamed.

In many large organisations middle management have to demonstrate the commerciality to senior management. The issue here is that many senior management are under pressure to deliver profits and believe that assistive technology for example is years behind up to date technology. Therefore from a reputational risk point of view they remain wanting to stay at the cutting edge and are often reluctant to invest in assistive technology



[source: Analysing and Federating the European assistive technology ICT industry, 2009]

Figure 2: Value chain in the Assistive ICT industry

Within the present model of service delivery in AT, it is national service delivery systems and procurement policies that largely determine the supply chain. Through Interviews, questionnaires and research, Pasteur confirmed that the power lies with the service delivery systems. This has a number of implications for the industry, each country has different policies in relation to procurement. The market is perceived as fragmented due to different national systems and this is making a limited market even smaller [Pasteur 2009]. “It is the service providers who prescribe devices, thereby many products are considered medical devices and under the remit of government departments of Health. In many countries the issue of AT has yet to be determined.” The final report of the Analysing and Federating the Assistive ICT Industry in Europe found that “The value chain in and of itself is particularly complex due to the key role of Service Provider organizations, which assume key responsibilities including product assessment and financing, and in most products serve as the principal agent between end-users and AT product manufacturers.” (p20)

Different models: Social, Medical and Consumer + Different languages[5]

	HEARING AIDS	BRAILLE READERS	APPLS FOR VOICE COMMUNICATION	SOFTWARE FOR COMMUNICATION	ENVIRONMENTAL CONTROL SYSTEMS
AUSTRIA	medical	social	social	social	social
BELGIUM	medical	social	social	social	social
DENMARK	social	social	social	social	social
FINLAND	medical	medical	medical	medical	medical
FRANCE	medical	social	consumer	social + consumer	social + consumer
GERMANY	medical	social	social	social	social
GREECE	medical	consumer	consumer	consumer	consumer
HUNGARY	medical	consumer	consumer	consumer	consumer
IRELAND	medical + consumer	medical + consumer	medical + consumer	medical + consumer	medical + consumer
ISRAEL	medical	social	social	social	consumer
ITALY	medical	medical	medical	medical	social
NETHERLANDS	medical	social	social	social	social
PORTUGAL	medical	consumer	medical + social	social + consumer	consumer
SLOVAKIA	medical	social	social	social	consumer
SLOVENIA	medical	medical	medical	social + consumer	social + consumer
SPAIN	medical *	consumer	social + consumer	social + consumer	social
SWEDEN	medical	medical	medical	medical	medical
UK	medical	social	social	consumer	social

Results in a **COMPLEX SITUATION FOR COMPANIES LOOKING TO SELL TO DIFFERENT MARKETS** (products and geography)

[5] Information provided by national contact points of AAATE, own elaboration.

tecnalia Inspiring Business

Figure 3: Different models of AT service delivery in EU countries

The medical model which pervades the service delivery has a large impact on the demand for Assistive ICT and it is the service providers who have the control of budgets and buyer power in the industry. National regulations standards often preclude devices being imported or exported. The system is slow and cumbersome and prevents the market directly dealing with the user. The consumer oriented model is taking ground in Europe, and there are plans to introduce new policies with funding going to direct to the user. As the consumer model becomes more widespread, end users will increasingly become important decision makers.

2.3. The suppliers

Accessible ICT

For the industry the cost of accessibility has been identified as a further problem, both in making the product accessible but also for distribution, it is considered costly to develop solutions in compliance for the different national markets. For instance software is especially important in the AT sector but at present, about 80% of the software that is available for AT applications is available only in English and software companies will only invest in developing editions in other languages if it is cost effect. Lack of interoperability is also an important issue, particularly with specialised programs.

The MeAC study by Technalia [2007/2011] also found that the field of goods, products and services that apply to ICT and eAccessibilty are both extremely complex and wide-ranging.

However, both the debate on ICT accessibility and the actions taken to date, are still largely focused on Internet and access to the Web and its developments. While these aspects are undoubtedly essential, and especially so in the fields of education or employment, this has been done to the detriment of other products and developments, such as those related to the audiovisual, communication and technological media aimed at enhancing independent living, which are also important aspects of inclusion. The study also cited lack of awareness on the existing eAccessibility policies by technology product or service providers as well as users.

Another reason is that, in many cases, technologies are developed in, and for, a global market, and in this context, it is not surprising that the effects of policies implemented locally may be blurred. Over the past decade, the EU States have recognised the increased dependency on ICT-based products and services people's daily lives, e.g. self-service terminals, online government and shopping, audiovisual services and mobile telephony. The EU accept that ICT accessibility has become an essential element for inclusion

Assistive ICT

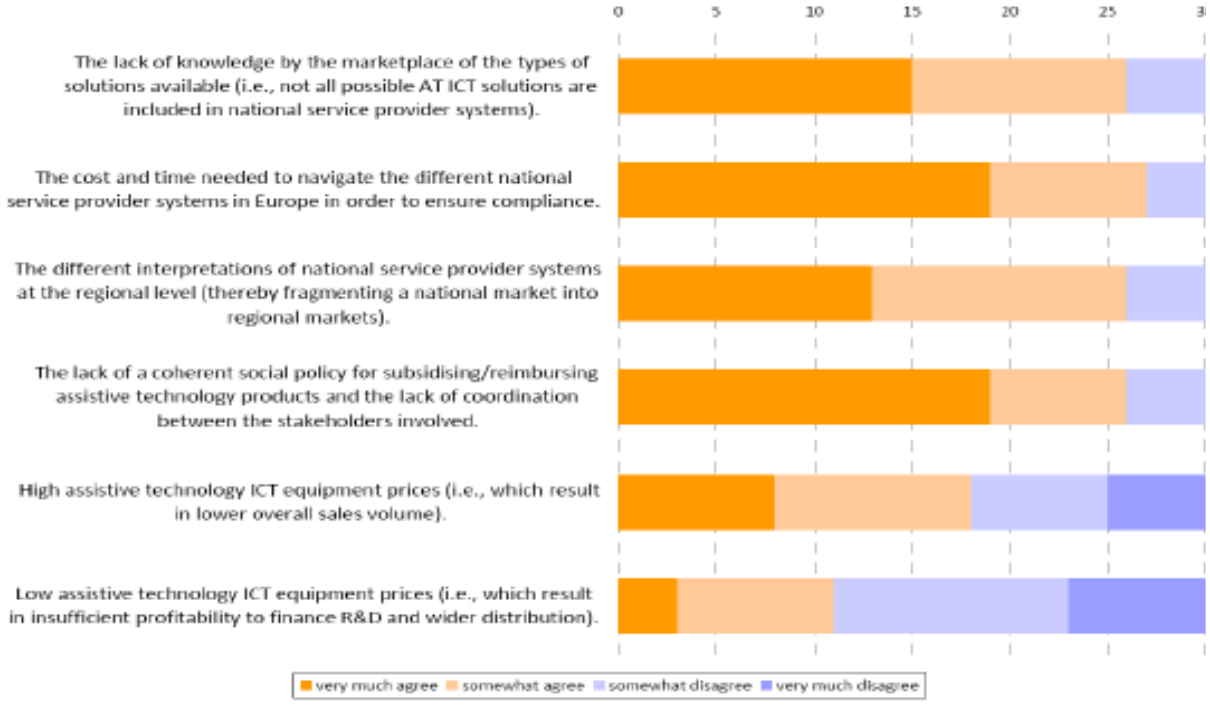
At market level, to a large extent, assistive ICT is characterised by SMEs, small and medium enterprises, while this is similar to America where 60% of the AT companies have less than 10 employees. This results in both positive and negative issues. SMEs look for smaller niches in the marketplace and often offer a more personalised service, an important facet of assistive technology.

The US Technology Related Assistance for Individual with Disabilities Act clearly underlines the individual nature of assistive technology: "Assistive technology service means any service that directly assists an individual, including the evaluation of the needs of an individual, the purchasing, leasing, or otherwise providing for the acquisition by an individual with a disability of an assistive technology device; selecting, designing, fitting, customising, adapting, applying, maintaining, repairing, or replacing assistive technology devices; training and technical assistance (1988)". However, the individual nature of the industry does preclude a mass market and given the size of these companies, the production volume tends to be small. Those that expand tend to have developed the product to appeal to a more general market. Furthermore developments in ICT are fast moving and for many small AT ICT firms, keeping up with the larger firms that characterise ICT is extremely difficult.

There are also important considerations in both time and money involved in negotiating with different national service provider systems in order to ensure compliance. This is further complicated by the various systems of service provision at the regional level. As many of the companies that develop assistive software are SME's, they do not have the resources to extend into further markets. The perception is that it is a complex situation for companies looking to sell to different markets. The majority of companies agree that the lack of knowledge of the marketplace of the types of solutions available is a serious barrier to the development of their business. The foremost common problem area found in the vast majority of firms, was the marketing challenge: "how to get the right product, via the right person, and with the right instructions and training to the disabled end-user who needs it". To some extent, this is a distribution and marketing challenge common to any industry, but in

the AT ICT industry in Europe, the complexity of the different service provider systems is an extremely potent force in the marketplace." [Analysing and Federalising Assistive Technology 2009 p8].

The Tecnalia study [2009] had similar results. In a poll of companies the principal barrier for companies competing in the assistive technology market was the cost and time necessary to navigate the national service provider systems. There were other reasons such as lack of knowledge in the marketplace, lack of a clear funding path and a coherent social policy for reimbursing. The report concluded that these issues resulted in a reduced choice of solutions for end users and a diminished market for companies reducing profit margins and sales.



[source: tecnalia]

Figure 4: Principal barriers for companies operating in the AT ICT industry

According to a questionnaire conducted by the "Analysing and Federalising Assistive Technology", 24/302 companies agreed that maintaining a European-wide distribution network represents an important cost for European Assistive Technology ICT companies. However, 22/303 disagree that selling to the North American market is more profitable (excluding exchange related risk) than to selling to the European market. From this the report it was concluded that EU companies' investment in their European distribution networks is the most attractive marketing option.

However, the AT ICT companies recognise the importance that mainstreaming will have on the industry. Pasteur also found that information via product databases such as EASTIN, ABLEDATA, etc and other national information resources will increase awareness among

[2] See Methodology Annex, Validation Questionnaire
[3] See Methodology Annex, Validation Questionnaire

end-users as to possible solutions that exist outside of their service provider systems. Increasing the level of available information for end-users should help the AT ICT industry to better market their products and services.

In general, reports to date have found that the AT ICT industry is complex, unclear and difficult to understand. These complexities are in large part due to the key role of the service providers which assume key responsibilities, including product assessment and financing, and in most products serve as the principal agent between end-users and AT product manufacturers.

3. Successes and Failures of Technology Transfer in ICT & AT – Analysis

3.1. Organisational and procedural processes to achieve accessibility of products and services – Technology transfer in Accessible & Assistive ICT in companies and related organisations

The practice of technology transfer is a developing discipline and central to both Accessible and Assistive ICT. Increasingly, the method of technology transfer is been recognised as central in the process of guiding technology-related prototypes, developed in the academic sector to product commercialisation within the business sector. (Lane 2010). Lane argues that the process of transforming a technology into a viable product arises from three initiating forces (a) technology supply push where new discoveries are offered to the field as opportunities to improve product features and functions; (b) market demand pull where customers define unmet needs as opportunities for new products within specific markets and (c) corporate collaboration, where internal corporate ideas for new products are refined through iterative cycle of input and feedback from external stakeholders.

It has long been a prerequisite of funding from most governments and the European Union that the academic, business and industrial sectors work closely together to ensure outcomes that have the greatest impact on the needs of the consumer.

Accessible ICT

Companies involved in Accessible ICT are generally characterised as large organisations which recognise the importance of accessible features to the overall market, they are orientated towards universal design [Pasteur]. Within the Accessible ICT market there is a recognition of the importance of Universal Design (UD). Many accessible features researched and developed are useful for all and by including consideration for accessibility in the design considerations from the outset of the development of the product or service, mainstream products can be more cost effective.

Targeting accessibility of ICT products to users with specific needs is recognised as a business opportunity, particularly within the growing aging population. The spending power of this group of consumers can be considerable and therefore including this group of potential product consumers may provide considerable market share gains. Large companies such as Microsoft and Apple recognised the importance of the market and have long built in accessible features in their operating systems. They also provide magnification options including lens mode and full-screen mode. On-screen keyboards can be personalised and resized to make it easier to see. Text prediction, speech recognition and touch technology are now common accessibility options.

Assistive ICT

Detailing how technology transfer occurs within assistive ICT proffers further difficulties. The assistive ICT is predominantly SMEs, operating at national level. Similarly to the Accessible ICT market there needs to be technology supply push to stimulate and improve product features and functions. There is an increasing demand for new products to support independent living as an older population increases and demographics indicate the demand will increase. Previous research has found that there are inherent difficulties in researching the AT ICT industry, it is multifaceted, and not especially transparent nor an easily understood industry.

These are the elements that were also highlighted in the extensive study of the AT ICT Analysing and Federating a European Assistive Technology Industry [Tecnalia 2009] concluded that the AT ICT industry in the EU certainly is not a simple one. It is complex in various aspects, for example for the large number of products, for the large number of small firms, and for the different service provider systems that are used to get AT ICT products to disabled end-users. The report further highlights the rapid developments made in ICT development leading to problems of simply trying to keep up with the new technology and further complicated by the nature of the SMEs in assistive technology compared to the sizeable multinational ICT firms.

3.2. Limitations in technology transfer mechanisms – overview

Until recently, many current technology transfer methods failed to recognise adequately the significance of recipient organisations' needs and therefore failed to address service delivery aspects of the technology and knowledge transfer process. That is to say that mechanisms tended to emphasise the marketing and selling of technology as products to organisations that had explicit needs and requests rather than providing a business service that aided the process of diagnosis and searching for and matching available technology to implicit needs.

It could be argued that some of this remains in that the current mechanisms tend to offer "technology" primarily in terms of technical and economic attributes, i.e., as a product, thus failing to consider the responses of organisations and the individuals within them to the opportunities and threats generated by technical change. Therefore, failing to understand the actual, and generally more limited, contribution of a candidate technology to competitive advantage or effectiveness.

Whilst the industry is improving and new approaches exist that help improve the transfer process, some may argue that in some cases, they under-estimate the importance of the interactive processes and mechanisms between the donor (vendor, intermediary, R&D organisation etc) and the recipient, necessary for successful transfer. They fail to recognise that successful transfer seldom involves just a simple one-off transaction but is a process or dialogue between a variety of actors in the two parties and involves a continuing relationship to the point where real benefit accrues to the recipient.

3.3. Research & Development – lack of impact/why?

Accessible ICT

There is a number of varying organisations involved in R&D companies, research centres, universities, and collaborations between these entities. It has long been part of government funding that these organisations work together to support industrial development. It has now virtually become a perquisite of 3rd level education that key faculties engage with R&D companies to source funding. Universities are committed to becoming leading international research-intensive and increasingly large universities, in order to attract funding, are forging partnerships. An example of this is the TCD/UCD Innovation Alliance in Ireland, a partnership that will work with the education sector, the State and the business sector to develop a world-class ecosystem for innovation and enterprise development as part of the government's strategy for the smart economy. Another example of collaboration in R&D involving the AT ICT industry is the Continua Health Alliance which began in June 2006 and has over 100 members, several of whom are large ICT companies such as Cisco Systems, IBM, etc. This alliance has as its stated mission to work together globally to establish interoperability standards for personal health care products and services, to enable new models of healthcare for people worldwide.

Assistive ICT

An example of collaboration in R&D involving the AT ICT industry is the Intel smarthouse technology working with the Association of Assistive Technology Act Programs (ATAP). These types of collaborations can be especially useful in AT ICT technology and product development since AT ICT research is largely dependent on R&D from other sectors such as telecommunications and electronics.

Importantly the Federating and Analysing the AT industry report found that in 'pushing' new technology there was a spin off dedicated to AT ICT from a multinational corporations (technology supply push). The technology which forms the base of the products and services sold by the new spin-off was developed by a non-AT related business group within the multinational. When a clear application and business case could be developed for serving the AT market, the activity was spun-off. They also found, particularly in the world of Electronic Control Systems, many specific product solutions are developed with a process such as "we need an alarm that signals when XX happens." (market demand pull) with the technological solution based around essentially the same three components: a type of sensor + radio signal + receptor/monitoring device.

The Communication from the European Commission in 2005 on e-Accessibility stressed the need for accessibility requirements and standards, which must meet the needs of industry, designers and providers without hampering creativity or innovation, while at the same time involving users in the development of standards. Interoperability should be key in standard setting and providing opportunities especially for SMEs with limited resources to purchase them and for users to access them.

3.4. New approaches to improve the transfer process

Traditionally technology transfer tended to be characteristically based upon the pre-occupation with creating “new technology” and “making it available” and failed to adopt a “client requirement” oriented approach. Due to constant review and research and the rise in market demand, this has changed substantially and many new approaches have been adapted.

A paper published by the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA), which represents the R&D-based pharmaceutical industry worldwide, documents the growing trend of technology transfer in medicines and vaccines. It also identifies the critical enabling conditions which allow technology transfer to contribute successfully to global economic development and health. Mr. Eduardo Pisani, IFPMA Director General, said: "Through technology transfer, R&D-based pharmaceutical companies are helping partner companies around the world to make advanced medicines and vaccines for their local markets. This is stimulating economic and social development, while also contributing to the health of recipient countries' populations. With appropriate government encouragement and continued engagement by our members, the benefits of this approach could be extended to more countries. WHO Member States have asked us to share our best practice in this area, and this is what our new paper delivers." The importance of transferring technologies for medicines and vaccines is recognized in the World Health Organization's Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property Rights. This calls on member states "to promote transfer of technology and production of health products in developing countries through identification of best practices, and investment and capacity building”. The new IFPMA paper "Technology Transfer: a Collaborative Approach to Improve Global Health – the R&D Pharmaceutical Industry Experience" seeks to contribute to policy discussions by providing a directory of more than 50 case studies, along with conclusions drawn from industry's 20 years of experience in this field.

The IFPMA paper identifies the risk of a "technology transfer gap": while middle income economies are involved in a growing number of pharmaceutical technology transfer partnerships, low income countries may not be so attractive as partners, as they may lack many of the enabling conditions for successful technology transfer. The paper therefore recommends that low income country governments should help to improve local companies' attractiveness as technology transfer partners, encourage them to focus initially on more accessible technologies and to create larger, regional markets through mutual recognition of medicine approvals with neighboring countries. High income countries can assist this process by technical means, such as giving low income countries greater access to international standard-setting bodies as a way of strengthening in-country competencies, as well as other forms of development assistance.

3.5. Analysis and descriptions of best practices

The problems associated with transferring assistive devices from the laboratory to being widely available are significantly different from those associated with introducing mainstream products and services which are usable by people with disabilities.

Best practices vary from country to country depending on regulation, funding, culture and business models. For example, some organsiations approach TT with the more complex concept of + “usability” rather than accessibility because for researchers developing new concepts and technological solution, effectiveness, efficiency and robustness are as crucial as accessibility-related aspects like learnability and satisfaction.

Organisations that excel in best practice are those who involve end users and intermediate stakeholders at the very early design/development stage. Live labs are a common tool for some of the larger organisations, however costs and time is now a factor given the current economic climate. Some suggested central European funding for central living labs across Europe. Others argued that sharing of knowledge would be difficult given the competitive-ness of the market.

Many organisations are also aware that after the end of the project there will be solutions that are not ready for the market and would need more research and more effort. They are not always able to give continuity to these solutions but work in open source. This facilitates the reuse of work by other organisations and provides a knowledge transfer of findings during research.

Overall, most agreed that best practice is to try to foresee in advance the TT of the research project. This process should consider optimistic and pessimistic scenarios in order to be prepared for different possibilities.

The use of open source guarantees that the solutions will be open for other organisations to keep up the work and not loose the knowledge acquired.

3.5.1. Examples of successful technology transfer in Assistive Technology

In the area of assistive technology for people with disabilities, many devices have been developed, some of which were successful, but most have failed to make the transition on from the laboratory to being generally available at affordable prices.

Successful examples of technology transfers include:

- *Tiresias,* a typeface designed to improve the legibility of subtitles on television screens for partially sighted people. A secret of its success was that it was marketed for only a nominal fee in the UK, where it was well received. It was subsequently marketed in other countries at a commercial price, and became a best seller.
- An eye drop locator, developed to help people with low vision administer their own eye drops, but also found useful by other people. The company sold 90,000 units in the first two months.

- Limited vocabulary speech recognition was developed to help those with poor manual dexterity, but is now common on mobile phone handsets.
- Predictive text was developed for disabled people who had to communicate, but it rapidly found a wider application for texting on mobile phones.

In some cases the devices have not met an unmet need, but there are many others where the technological aspects of the device were excellent and it was potentially useful. The difference between devices for disabled people and general technical developments is that the market is not simple – the inability of the potential user to afford the full price of the product coupled with the peculiar subsidies which vary from one sector to the next mean that this area requires extensive experience to negotiate the various pitfalls.

One technique which has been used to good effect has been not to fund the research directly but to agree to pay a considerable price for the first few units which reach the market with the appropriate support facilities in place. The regulations regarding subsidy to assistive devices varies from one country to the next, and it can also vary by application (e.g. in education on or employment). This situation does not appear likely to be resolved in the foreseeable future, so those marketing assistive devices need clear guidance as to the various systems of subsidy which are currently in use in various areas and countries.

Not all devices are for individual use. For instance audio beacons to help blind people navigate public spaces have been piloted in many countries. Once the manufacturers insist on using proprietary protocols whereas the purchasers want systems based on open standards so that they are not trapped in a single supplier situation.

3.5.2. Technology transfer in Accessible ICT

Designing accessible mainstream information and communication on technology (ICT) systems requires developers to have a good understanding of the aspects which affect the ability of individuals to use specific systems and services. All too often designers consider accessibility issues too late in the design process; like quality, accessibility needs to be considered from the outset and not added at the end of the process like a coat of paint. Traditionally designers would test prototypes with a range of potential users to identify any problems.

However, nowadays the speed of converting a concept into a production model often means that there is no prototype to test, so all evaluation has to be done with computer simulations.

Many companies put short-term profitability ahead of the need to improve usability and accessibility of their products. Sometimes this is due to ignorance of the real needs of people with disabilities; this situation has not been helped by the fund-raising image of some user organisations being associated with a particular group with very special needs. The usual image of a disabled person is someone in a wheelchair or someone who is totally blind or totally deaf. These people exist but more typical is an individual who has a combination of impairments.

3.5.3. Thinking more widely about the uses of technologies

Another role could be to work with organisations in other areas to identify which of their technologies could be useful for people with disabilities. This is particularly relevant in the area of military developments but problems of commercial secrecy and sensitive information create an extra hurdle to be overcome.

When considering the development of products for use by blind people it is interesting to think about the telephone, the fountain pen, the typewriter, and the long-playing record. They have all proved useful to blind people for many years, but would they ever have ever become viable products if the market for them was just blind people?

A deep sea diver breathing helium has a high pitched voice – the technology for changing the pitch is the same as that needed by a blind person listening to a speeded up talking book.

3.5.4. Market support

It is often important to look for applications outside the disability area which can make a significant difference to the economic viability of the product or service. Potential application areas need to be studied systematically and not by serendipity.

Funding for research and development projects for assistive technology should include the stage of technology transfer. Many funding bodies restrict funding to pre-competitive research without recognising that the area of assistive technology requires a different approach. It has been suggested that companies should receive tax breaks for providing accessible products and services; this could be an administrative nightmare to implement in a manner such that companies do not find loopholes to claim the benefit while not investing in accessibility.

When marketing a product based on new technology it is important not to blind the disabled customer with technical jargon but concentrate on what the new device can and cannot do to help a disabled individual. There have been a number of instances where public relations companies have over hyped a new product such that the disabled community reject it without even examining what help it could provide.

There are a number of different ways of measuring the prevalence and incidence of various impairments which marketing departments tend to find very confusing. The situation is not helped by the fund raising departments of some non-profit agencies using exaggerated figures which have no scientific basis. What is needed is data based on the sales on other products in the same segment.

3.5.5. Mandatory requirements

Legislation and/or regulation can be used to require certain features in a product or service. However it has proved to be very difficult to write such specifications which achieve the desired objectives whilst not limiting the designer in the use of new technologies.

Open international standards have proved to be useful despite being inconsistent or out of date (possibly because they are based on superseded technology). The existence of patents can stymie development by introducing delays which correspond to extra costs for the organisations developing the new product.

An alternative approach is legislation which requires public systems to be accessible, but does not define how this should be achieved or what is the precise meaning of ‘accessible’. This approach has the advantage that it does not restrict the use of new technologies, but it creates income for the legal profession (whose costs end up being added to the price of the product).

A requirement for companies to publish their corporate social responsibility (CSR) policies in respect of accessibility could be beneficial. Currently many CSR policies reflect to what the company aspires. Making CSR policies in the public domain gives the possibility of outside organisations exerting pressure on companies to implement policies.

3.5.6. Procurement policies

There are two particular ways in which policies on public procurement can be expected to influence the availability of goods and services that are accessible to people with disabilities and older people. Firstly, there is the direct result when the required accessibility features are demanded by the purchasing authority within the terms of contract. Secondly, there is an indirect effect through which the purchasing practices of public bodies have an influence on wider product design in the relevant industries. The magnitude of this indirect effect will vary because of differences in national purchasing approaches.

Public bodies that need to buy goods and services, whether it is for general purposes or specifically to make provision for people with disabilities, will tender for their supply. The tender documents will usually be accompanied by a technical specification that describes the required product and forms the basis for the ensuing contract. Any accessibility features that are needed will be detailed in the specification, using published standards where they exist.

In the European Union, there is a clear obligation to use European Standards where these are available, and there is also a clear requirement to consider accessibility in all public forms of tendering. Currently the CEN Project Team are designing and developing the European online procurement Toolkit for Accessible ICT products and services. [http://www.mandate376.eu/] Sseveral countries have developed toolkits for use by procurement bodies for procuring Accessible ICTs. When tendering for ICT equipment it is common practice to buy a service package rather than just the hardware, so that maintenance and updating is included in the same contract. Nevertheless, the accessibility requirements can still be set out in the contract, although this may mean that they are provided to specific need rather than being incorporated in all of the equipment delivered. This customised approach may be particularly valuable in respect of telephone extensions on private branch exchanges.

Some purchasing bodies, particularly the FCC in the USA, have a policy of purchasing only standard commercially available items, but at bulk prices. This has the effect upon the

market of encouraging all manufacturers to incorporate all the required accessibility features in their products, for otherwise they would not be eligible for that purchaser's contracts. In other instances suppliers are free to design and manufacture to the contract specification, or to modify a product on design by adding or removing features so as to meet the specification at a competitive price. In these cases the public purchasing will have less influence on the general availability of accessibility features and it is not unknown for a product that incorporates certain features for one market-place to have them removed in another. The rationale for this is presumably to make savings in cost, weight or power consumption.

These comments upon public procurement may be applicable beyond the public sector. Large private sector organisations which operate a central procurement facility can achieve similar results in creating awareness and influencing behaviour among suppliers. If these organisations find that they need accessibility features to enable recruitment and retention of employees with disabilities, especially where that is a feature of national equality legislation, their purchasing practices will be a powerful influence upon the design of equipment and services.

3.5.7. The way forward

The current situation regarding technology transfer is unsatisfactory in that relatively few research and development projects result in products or services of practical benefit to people with disabilities. In the short term, there is an unmet need to provide independent guidance to companies developing new products. This could take the form of a series of guidebooks and/or the provision of broker agencies specialising in technology transfer issues.

In the medium term, the implementation of European accessibility requirements for government procurement in member states would be a significant step forward. This is likely to require the development of some new standards since it is essential that they are based on sound scientific data.

4. Recommendations towards a Roadmap of Actions Supporting the Technology Transfer in Accessible & Assistive ICT

4.1. A model of technology transfer in Accessible & Assistive ICT

Technology Transfer *Definition*

> *"Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. It is closely related to knowledge transfer."*
>
> *[Wikipedia July 2011]*

In this definition '**users'** mean organisations that apply or exploit technology, typically for research or commercial purposes; it does not mean 'end-users' as the users or customers of the developed end-products and services.

However, end-users play an important role in our model of technology transfer as we regard the **ultimate goal of the technology transfer in Accessible and Assistive ICT** is the meeting of the end-users' needs.

Although not part of the technology process itself, we consider consumer **market-related aspects**, like service delivery, public procurement, and financing of Assistive Technology, as relevant because they can have a strong indirect influence on technology transfer.

The process of technology transfer is never ending because new technology is perpetually generated, i.e. invented and developed.

Facets of technology transfer

Various **facets** or aspects in the process of technology transfer are regarded:

1. End-user needs that are known and respected
2. Awareness – knowledge – skills concerning Accessible & Assistive ICT
3. Procedures – tools – methods – environments to realise Accessible & Assistive ICT
4. The technology transfer process in an organisation to realize Accessible & Assistive ICT
5. Technology transfer networking between stakeholders
6. Market and market supports
7. Policy to support technology transfer

Stakeholders

The following **stakeholder groups** have been identified to be involved or to have significant influence on technology transfer in Accessible & Assistive ICT:

- end-users (typically private people: people with disabilities or special needs, elderly people) and their organisations (e.g. disability groups, forums and associations of people with disabilities and elderly people)
- caregivers, family members & friends, therapists & rehabilitation professionals, organisations supporting life at home – as secondary end-users
- researchers
- mainstream ICT product & service developers / manufacturers / dealers / wholesalers / providers
- Assistive ICT product & service developers / manufacturers / dealers / wholesalers / providers
- educational and training organisations: universities, life long learning entities, etc.
- advisors & consultants, information services
- technology transfer agencies, chambers of commerce
- standardization bodies
- IPR management
- public procurement
- government authorities (e.g. public bodies, governments and government agencies, regulators) and EU Commission
- policy makers, parliaments, legislators
- market researchers

The following stakeholder groups may have an indirect influence on technology transfer:

- business associations
- financing organisations (public / private social security service providers and insurance companies, venture capitalists)
- service delivery actors

Activities and actions

The identified stakeholder groups have different roles. '**Activities**' describe what they can do – directly or indirectly – in order to support technology transfer in Assistive and Accessible ICT. '**Actions**' mean strategic actions and combine corresponding activities in the context of the different considered facets of technology transfer.

Technology-driven and demand-driven ICT

There are potential chances and potential problems with new ICT:

- New technology as a chance: New technologies yield new products and services which may help to avoid or to overcome barriers for people with disabilities. (Assistive solutions or improved accessibility of mainstream ICT products)
- New technology as a problem: New technologies yield new products and services which may (at the beginning) not be accessible by people with disabilities. (Accessibility problem of new mainstream products)

While the emergence of new technologies in the area of mainstream ICT drives the development of innovative products and services ("technology driven"), the realization of accessibility of such products is usually behind the general development. Accessibility is realized because it is required by law or by regulations, e.g. in public procurement. Demands from the market concerning accessibility are relatively small, compared to the whole market size. – However, due to the demographic shift, there is a tendency that the market demand for accessibility of products is increasing.

The market size of Assistive ICT is very small compared to the market size of mainstream ICT. The development of new products and services is mainly driven by still unmet needs of end-users ("demand driven"). The emergence of new technologies provides opportunities to develop new or better solutions.

The markets of (Accessible) mainstream ICT and of Assistive ICT have differences and similarities. Therefore we distinguish the ways of technology transfers related to these two different markets – even if the technologies themselves may be identical.

4.2. Methodological approach towards a roadmap

It is important to note that in Workpackage 1 the envisaged "**technology transfer roadmap**" is not a roadmap of technology transfer itself but a **roadmap of actions to support technology transfer**.

In contrast to this, the roadmaps to be developed in Workpackages 3 and 4 will deal with the generation and transfer of technology in certain areas of ICT.

4.2.1. Two settings: technology transfer in Accessible ICT & technology transfer in Assistive ICT

According to the potential differences (and similarities) in technology transfers in mainstream ICT versus Assistive ICT we continue to distinguish in our methodological approach towards a roadmap of actions supporting technology transfer in both areas.

The envisaged roadmap shall consist of a plan of realistic actions (and activities) in a given timeframe, that will support the technology transfer to approach its ultimate goal, i.e. to meet the end-users' needs.

In this sense, our envisaged roadmapping is process-oriented (technology transfer process) and goal-directed (to meet the end-users' needs).

When we talk of “a roadmap” this does not mean that all proposed actions to support technology transfer will be identical for the two areas. We look for potential similarities and differences. At the end it will be a pragmatic decision whether to split into two independent roadmaps or to go for one common roadmap.

4.2.2. Steps of road-mapping

The CARDIAC technology transfer roadmapping process comprises the following **systematic steps**:

1. Describe and analyse the **current situation**.
   The results are described in Chapter 2: “The Market of Accessible ICT & Assistive ICT” and Chapter 3 “Successes and Failures of Technology Transfer in ICT & AT – Analysis”.
2. Build a **vision** of a desired future (5 to 15 years) with respect to technology transfer.
   The vision is an implicit result from the 1st CARDIAC SDDP workshop on technology transfer, especially from the explanations of the generated ideas.
3. Identify the **gaps** between the current situation and the vision and identify supporting factors (“**bridges**”) and limiting factors (“**barriers**”) in realising the vision.
   This step is based on the analysis and comparison of the current situation with the vision.
4. Identify **activities to overcome the gaps**.
   A structured list of ideas for activities was a major outcome of the 1st CARDIAC SDDP workshop. (In the course of the project, this list was complemented with results from the 2nd CARDIAC SDDP workshop, ICT companies interrogation, and literature study.)
5. Prepare a **first plan of activities** to reach the vision.
   The first plan of action in form of a dependency graph was the second major outcome of the 1st CARDIAC SDDP workshop.
6. Build a **draft roadmap** with goals, actions, sub-actions, involved stakeholders, and potential support activities of the European Commission.

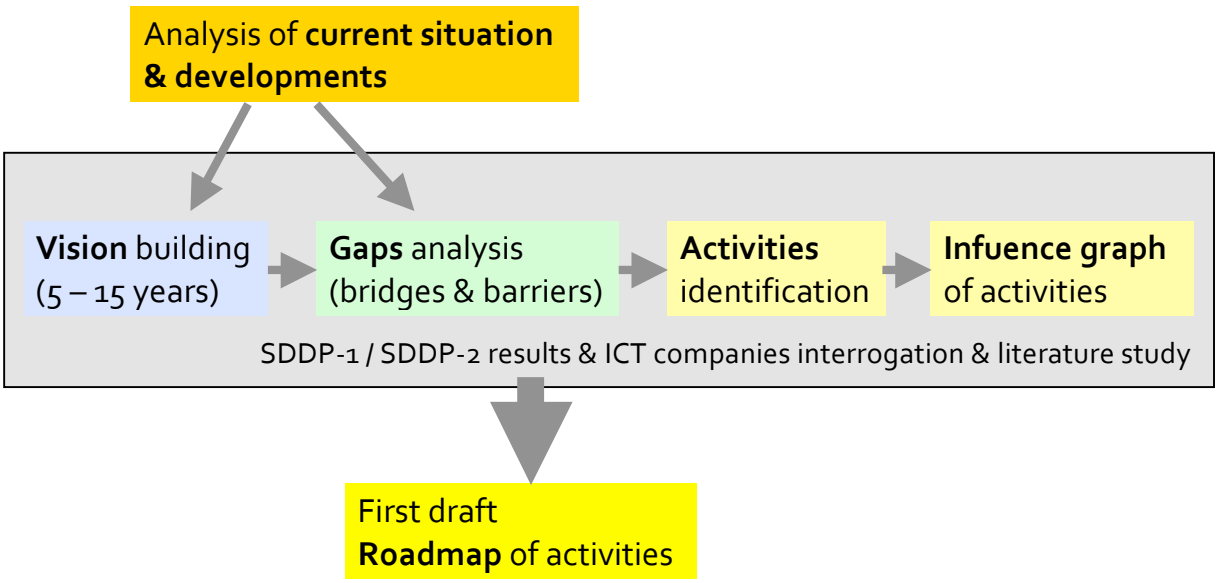


Figure 5: First steps of road-mapping

While in the ideal case, the whole sequence of steps is gone through only once, there is the opportunity to cycle back from each step to one of the previous steps if necessary. This gives the chance to include new findings from other sources later on (other projects, feedback from external experts, future SDDP meetings) and so to enhance the roadmap without destroying earlier results.

Three further steps will follow in the course of the CARDIAC project:

7. Verify the first action plan by validating the **adequacy and feasibility of the actions**. This includes also a match of the actions/ activities against the activities of the draft research roadmaps generated in WP3 “Inclusive Human-Machine Interaction” and in WP4 “Network-based Applications”.
8. Enhancement of the action plan and of the draft roadmap taking into account the findings of **Task T1.2** which will involve conducting a state-of-the-art study about solutions that support developers of mainstream ICT-based products and services to realise accessibility and of **Task T1.5** which will involve the identification and mapping of existing technology transfer supports, institutional and commercial available throughout the EU. – Build a **roadmap** including milestones, time schedule, and ways of coordination / cooperation / collaboration of stakeholders.
9. Verification of the action plan and roadmap in a final workshop with external experts in **Task T2.4**.

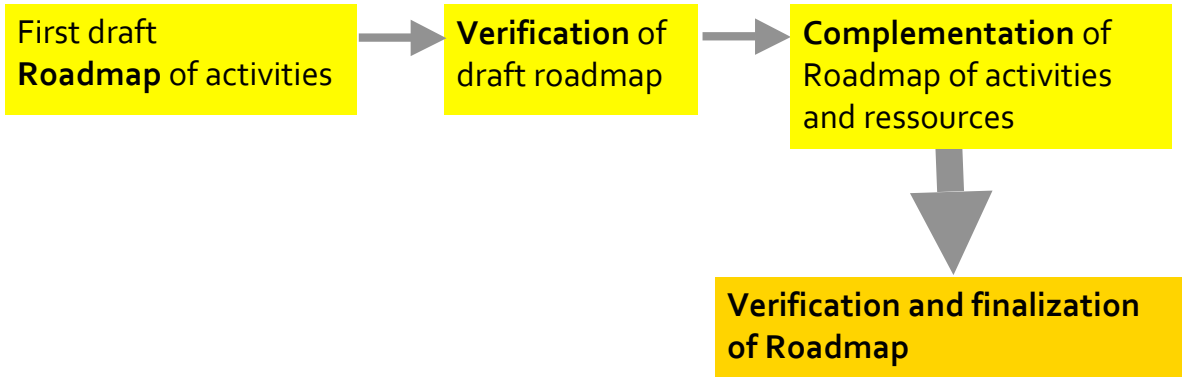


Figure 6: Future steps of road-mapping

4.2.3. Sources of information

The CARDIAC TT roadmapping process builds on various sources, including the expertise of various stakeholders:

- results from the 1st CARDIAC SDDP workshop on TT (vision building, gap identification, and activity identification) with the participation of external experts representing different types of stakeholders
  (see "8.1.2 Description of mechanisms to support technology transfer"; references to statements are numbered by "**#...**')
- results from the 2nd CARDIAC SDDP workshop on HCI (activity identification)
  (see "8.2 Selected results of the second SDDP co-laboratory on "Inclusive HCI research" relevant for technology transfer"; references to statements are numbered by "**SDDP2#...**')
- results from the interrogation of ICT organisations (gap identification and activity identification)
  (see "8.3.8 Recommendations to improve TT in Accessible ICT"; references to statements are numbered by "**Q~...**')
- results from other projects (description of current situation and activities identification)

It may be enhanced by

- feedback from external experts and from reviewers
- results from the 3rd CARDIAC SDDP workshop on Network-based Applications (activity identification)

4.3. A vision of technology transfer in Accessible ICT & Assistive ICT

The following lists present a summary of visionary ideas for technology transfer, how the desired future in 5 to 15 years should look like, from the 1st CARDIAC SDDP workshop, derived from the ideas for supportive mechanisms and their explanations. (The references show the numbers of the corresponding idea descriptions; see Annex.)

4.3.1. A vision of technology transfer in Accessible ICT

Vision facet VFacc-1: End-user needs that are known and respected

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-1:** **End-user needs that are known and respected**	• End-user needs are known. (from #1/#79) • The product developers have end-user needs in mind and are able “to sell” their products to the end-users. (from #51) • The end-user is in the focus of “technology design”. (from #44) • End-users and their organisations are able to effectively demand their needs concerning accessibility of products and services. (from #22) • Potential “personal barriers” in the application (or avoidance) of ICT products and services are known. (from #31) • End-users well understand their personal accessibility requirements. (from Q~1)

Vision facet VFacc-2: Awareness – knowledge – skills concerning accessibility in ICT

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-2:** **Awareness – knowledge – skills concerning accessibility in ICT**	• Mainstream industry realizes the real market potential and the wide user base of Accessible ICT products and services. (from #18) • There is an awareness that Assistive ICT and Accessible ICT can be closely related. (from #16) • Developers working in mainstream ICT industry are well educated and trained with respect to e-inclusion and accessibility. (from #17, SDDP2#54) • "Accessibility" and "Design-for-All" is standard in engineering curricula. (from #84) • People are aware of requirements and solutions concerning accessibility. Missing accessibility is no longer accepted. (from #24, SDDP2#42) • Developers are highly motivated to the available knowledge and tools for achieving accessibility. (from SDDP2#49) • People are aware of the technology potential to support an inclusive life. (from #36) • People with disabilities actively use Accessible ICT products and services. (from #39) • People with disabilities understand and are able to adapt and to use the existing accessibility features of ICT products. (from Q~20) • Industry considers end-user needs and their specifications. (from #54) • Researchers doing basic research are aware of the application field of Assistive and Accessible ICT. (from #55) • "Accessibility" is a research field on its own. (from #55) • Criteria for successful technology transfer and success stories are well known. (from #71) • The economical and social effects of successfully implemented and of potential Assistive and Accessible ICT solutions are studied and published. (from #10) • Companies are aware that the accessibility of their products is a positive feature, that many customers could benefit from it, and that it could be a competitive advantage. (from #72)

Vision facet VFacc-3: Procedures – tools – methods – environments to realise accessibility of ICT

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-3:** **Procedures – tools – methods – environments to realise accessibility of ICT**	• There exist international standards and guidelines that show the requirements for accessibility and give guidance in product/service development. (from #3) • End-users are involved in all phases of product/service development and life cycle. (from #23) • Mainstream ICT products and services provide open interfaces that let them interact in a seamless way with other products and services, including Assistive ICT. (from #12, #25) • Consistent and adaptable user interfaces are defined and realized. (from #21) • There exist standards and guidelines for interoperability of ICT products and services, including Assistive ICT. (from #33, #65) • ICT products and services are reliable, robust and secure. (from #63) • Methodologies, procedures, easy to use tools, test environments, and human experts are available for the purpose of testing the accessibility of mainstream ICT products and services. (from #15, #86) • Technical solutions to achieve accessibility of products (including software modules, technical descriptions, guidelines, technical know-how) are available off the shelf. (from #35, #53)

Vision facet VFacc-4: The TT process that realises accessibility in ICT

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-4:** **The technology transfer process that realises accessibility in ICT**	• Mainstream ICT companies push the accessibility of their new developments as well as they push the technologies for their developments. (from #77) • Product/service developers apply international standards and guidelines that show the requirements for accessibility and give guidance in. (from #3) • "Accessibility" is an integral part of companies philosophy of product and service design. (from #9) • The product features summarized under "accessibility" and "design-for-all" are understood standard design features of ICT products and services. (from #28) • The mechanisms of TT are understood; the resources for information and advice are known; examples of good practice are available; common fallacies and causes for failures are known. (from #1/79, #56) • ICT products and services offered to end-users are well elaborated, i.e. are well operational and meet the users' needs; the TT process has reached its final goal. (from #11) • TT from other areas of research, e.g. aerospace industry or military industry, is systematically supported. (from #88) • New solutions, products and services are smart and creative. (from #5) • New research projects focus on real technological innovations instead of marginal improvements, in order to produce significant advantages for users. (from #37) • Innovation in the field of Assistive ICT is taken into account when developing new "accessible" mainstream ICT. This means TT from Assistive ICT to Accessible ICT. (from #7) • Know-how from the development of Assistive ICT is taken into account when developing new "accessible" mainstream ICT. This means TT from Assistive ICT to Accessible ICT. (from #43) • Public funded projects share their knowledge and results. Public findings of research projects, e.g. from EU projects, are archived in a public repository. (from #74) • Product design is based on end-user needs. (from #62) • "Accessibility" of their products and services is part of companies' corporate social responsibility policy. (from #83)

Vision facet VFacc-5: TT networking between stakeholders

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-5:** **Technology transfer networking between stakeholders**	• The different actors in TT know how to cooperate effectively and how to transfer technology among themselves. (from #56) • The different stakeholders know the interests and responsibilities of each other. (from #68) • "Broker Agencies" bring together stakeholders and provide information to support the TT process. (from #27) • Academia, industry, and end-users meet and cooperate. (from #44) • The information exchange between researchers and developers from different technological areas (which are typically not related or are not used to cooperate among each other) is supported. Potential synergies are identified, redundancy is avoided. (from #44) • People of the "inclusion community" share their special knowledge with people outside this community. (from #57) • A Global Public Inclusive Infrastructure is built up. (from #29) • An Innovation Partnership on active and healthy aging is exercised [Communication COM (2010) 546 final, published by the European Commission, presents the Europe 2020 flag-ship initiative "Innovation Union". Annex III. (from #30) • Accessible ICT is closely related to the e-health market. (from #48) • Relevant stakeholders practice networking and benefit from each other's expertise. (from #64)

Vision facet VFacc-6: Market and market supports

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-6:** **Market and market supports**	• Accessible products and services are not more expensive than not accessible ones (as long as those still exist). (from #70) • A model for project idea evaluation exists and is applied such that “good” project ideas can be effectively supported from an early stage. (from #6) • Suppliers of “accessible” ICT products receive a financial benefit, e.g. tax incentive, in contrast to suppliers of “not accessible” ICT products. (from #20) • Up-to-date market data concerning end-users are available, including end-user needs, potential size of market demand, marketing requirements, service provision requirements, public procurement etc. (from #46, #61) • Innovative and useful technological developments make it to the market. There exists active or financial support to bring such developments to the market. (from #49) • Marketing and PR of Accessible ICT solutions is end-user oriented. (from #75)

Vision facet VFacc-7: Policy to support TT

Setting: **Technology transfer in Accessible ICT** **Vision facet VFacc-7:** **Policy to support technology transfer**	• Public procurement requirements reflect end-user needs. (from #1/79) • Legislation concerning the accessibility of ICT is well coordinated in the EU. (from #40) • Besides the economic value, the social value of Assistive and Accessible ICT is regarded in political decisions. (from #19) • There is a 'green' agenda for accessibility of ICT. (from #60, #87) • Publicly available products and services fulfil accessibility requirements throughout the EU. (from #32) • International standards for ICT products and services include the aspect "accessibility". (from #34) • Open standards for Accessible ICT systems are based on sound scientific and up-to-date data. The existing standards to not contradict each other. (from #41) • The application of clear accessibility criteria are part of public procurement policy. (from #42) • The availability of accessible technology is a human right. (from #47) • Countries, organisations and companies implement accessibility, especially if they receive funds for R&D. (from #67) • The UN Convention that refers to e-accessibility has been implemented in all EU states. (from #69) • There is consistent legislation and/or mandatory regulation in the EU countries. (from #81) • Legislation and mandatory regulations with respect to the accessibility of ICT systems have been harmonised within the EU countries. (from #81) • There is public funding for small, practical and goal-oriented projects in Accessible ICT; application and funding procedures are simple. (from #73, #76)

4.3.2. A vision of technology transfer in Assistive ICT

Vision facet VFass-1: End-user needs that are known and respected

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-1:** **End-user needs that are known and respected**	• End-user needs are known. (from #1/#79) • The product developers have end-user needs in mind and are able "to sell" their products to the end-users. (from #51) • The end-user is in the focus of "technology design". (from #44) • Potential "personal barriers" in the application (or avoidance) of assistive ICT products and services are known. (from #31) • End-users and their organisations are able to effectively express and explain their needs concerning assistive ICT products and services in a concise way, going beyond their personal case. (from #26)

Vision facet VFass-2: Awareness – knowledge – skills concerning Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-2:** **Awareness – knowledge – skills concerning Assistive ICT**	• People and companies starting to get involved in Assistive ICT find a rich base of relevant knowledge and data. (from #74,#57) • Public funded projects share their knowledge and results. Public findings of research projects, e.g. from EU projects, are archived in a public repository. (from #74) • There is an awareness that Assistive ICT and Accessible ICT can be closely related. (from #16) • People are aware of the technology potential to support an inclusive life. (from #36) • People with disabilities actively use new Assistive ICT products and services. (from #39) • Researchers doing basic research are aware of the application field of Assistive and Accessible ICT. (from #55) • "Assistive Technology" is a research field on its own. (from #55) • Criteria for successful technology transfer and success stories are well known. (from #71) • "Accessibility requirements of people with disabilities" is standard in engineering curricula. (from #84) • The economical and social effects of successfully implemented and of potential Assistive and Accessible ICT solutions are studied and published. (from #10) • Companies are aware that additional "assistive functions" in their products would be a positive feature (added value), that

	customers could benefit from it, and that it could be a competitive advantage. (from #72)

Vision facet VFass-3: Procedures – tools – methods – environments to realise Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-3:** **Procedures – tools – methods – environments to realise Assistive ICT**	• Assistive ICT products and services interact via open interfaces with mainstream ICT products and services in a seamless way if those products and services cannot be personalized in an appropriate way. (from #12, #25, #64) • There exist standards and guidelines for interoperability of ICT products and services, including Assistive ICT. (from #33, #65) • ICT products and services are reliable, robust and secure. (from #63) • Environments are available for the purpose of testing the interoperability of ICT products and services. (from #86) • Methodologies, procedures, easy to use tools, test environments, and human experts are available for testing the usability of Assistive ICT products and services. (in analogy to #15)

Vision facet VFass-4: The technology transfer process that realises Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-4:** **The technology transfer process that realises Assistive ICT**	• ICT products and services originally intended to be “Assistive ICT” are modified or used as comfortable and “accessible” ICT products/ services being “designed for all”. (from #28) • The mechanisms of TT are understood; the resources for information and advice are known; examples of good practice are available; common fallacies and causes for failures are known. (from #1/79, #56) • ICT products and services offered to end-users are well elaborated, i.e. are well operational and meet the users’ needs; the TT process has reached its final goal. (from #11) • New solutions, products and services are smart and creative. (from #5) • New R&D projects focus on real technological innovations instead of marginal improvements, in order to produce significant advantages for users. (from #37) • Product design is based on end-user needs. (from #62)

Vision facet VFass-5: Technology transfer networking between stakeholders

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-5:** **Technology transfer networking between stakeholders**	• TT from other areas of research, e.g. aerospace industry or military industry, is systematically supported. (from #88) • The different actors in TT know how to cooperate effectively and how to transfer technology among themselves. (from #56) • The different stakeholders know the interests and responsibilities of each other. (from #68) • Academia, industry, and end-users meet and cooperate. (from #44) • The information exchange between researchers and developers from different technological areas (which are typically not related or are not used to cooperate among each other) is supported. Potential synergies are identified, redundancy is avoided. (from #44) • People of the “inclusion community” share their special knowledge with people outside this community. (from #57) • Know-how from the development of Assistive ICT is transfered to developments of new “accessible” mainstream ICT. This means TT from Assistive ICT to Accessible ICT. (from #43) • A Global Public Inclusive Infrastructure is built up. (from #29) • An Innovation Partnership on active and healthy aging is exercised [Communication COM (2010) 546 final, published by the European Commission, presents the Europe 2020 flag-ship initiative “Innovation Union”. Annex III. (from #30) • Assistive ICT is closely related to the e-health market. (from #48) • Researchers doing basic research cooperate with researchers in the application field of Assistive and Accessible ICT. (from #55) • Relevant stakeholders practice networking and benefit from each other’s expertise. (from #64)

Vision facet VFass-6: Market and market supports

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-6:** **Market and market supports**	• A model for project idea evaluation exists and is applied such that “good” project ideas can be effectively supported from an early stage. (from #6) • Innovative and useful technological developments make it to the market. There exists active or financial support to bring such developments to the market. (from #49) • The product development until marketing of innovative Assistive ICT is progressively financially supported. (from 8, #13) • Chances and potential barriers in bringing new Assistive ICT to the market are understood. (from #50) • The market of Assistive ICT is regarded in relation to other markets, e.g. the e-health market. (from #48)

Vision facet VFass-7: Policy to support technology transfer

Setting: **Technology transfer in Assistive ICT** **Vision facet VFass-7:** **Policy to support technology transfer**	• The requirements and conditions of financial support for the provision of Assistive ICT for end-users are well known, both for providers as well as for end-users. (from #1/79, #82) • There is consistent legislation and/or mandatory regulation in the EU countries. (from #81, #40) • Legislation and mandatory regulations with respect to Assistive ICT systems have been harmonised within the EU countries. (from #81) • Besides the economic value, the social value of Assistive and Accessible ICT is regarded in political decisions. (from #19) • Organisations, especially SMEs, are well aware of relevant IPR (intellectual property rights) and its management. (from #80) • There is public funding for small, practical and goal-oriented projects in Assistive ICT; application and funding procedures are simple. (from #73, #76)

4.4. Bridges and barriers in achieving the vision

The following lists present the supportive factors ("bridges") and the limiting factors ("barriers") in realising the "vision"; based on the analysis of the current situation and the vision. (The references indicated the number of the related ideas from the 1st CARDIAC SDDP workshop.)

4.4.1. Bridges and barriers in technology transfer concerning Accessible ICT

Vision facet VFacc-1: End-user needs that are known and respected

Bridges:	**Barriers**:
• Many studies on end-user needs (concerning people with disabilities and elderly people) have been made; much knowledge is already there – in the Assistive Technology area. • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (**#44**) • There are many user organisations (e.g. of people with disabilities) who can speak for their members and demand accessibility. (#22)	• Taking into account the various abilities and disabilities of end-users, their individual needs and requirements concerning accessibility vary significantly and are sometimes combined. (**#1, #31**) • ICT is developing very fast. New products and services appear frequently on the market while the life span of products is often rather short. • People with disabilities (as end-users) are usually in the direct focus of companies and organisations doing R&D in Assistive ICT. (**#44**) • New developments in mainstream ICT are usually not driven by accessibility needs of end-users. – Typically it is the other way round: Deficits in accessibility of products are detected after market introduction; end-user needs concerning accessibility are regarded as "extra" requirements. (#51, **#44**) • End-users and technical developers usually think in different categories. There is a principle problem of understanding each other. (#22) • End-users have problems in knowing or expressing their personal accessiblity needs. (Q~1)

Vision facet VFacc-2: Awareness – knowledge – skills concerning accessibility in ICT

Bridges:	**Barriers**:
• Much knowledge on accessibility can be derived from the Assistive Technology sector. (**#16**) • "Human factors" is a subject in university education. (**#17**, #84, #55) • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (#24)	• Most of the people currently working in ICT have never received any education or training on accessibility issues. (**#17, #36**, #84, #54) • Mainstream ICT companies are usually quite different from companies active in Assistive ICT. (**#16**) • Many (potential) end-users consider themselves as 'too stupid' when they cannot use ICT products and services, i.e. they see the deficit in their own ability rather than in the features of the product. (#72, #24, #54) • Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the burden (time) of always learning new things without an obvious benefit for the person. – Especially true for elder people. (Q~20) • Are there success stories? (**#71**) • Detailed information in certain areas is difficult to find which can restrict progress. (Q~6) • So much new technology and continuous change in ICT. Therefore there is no stable knowledge; therefore knowledge on accessibility of ICT needs to be updated frequently. (Q~7)

Vision facet VFacc-3: Procedures – tools – methods – environments to realise accessibility of ICT

Bridges:	**Barriers**:
• There exist already working groups for international standards and guidelines on accessibility of ICT. (**#3**) • The provision of adaptable user-interfaces widens the range of potential customers of a product.. (**#21, #25**) • There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. (**#3**, **#15**)	• The elaboration of guidelines and standards is usually years behind the technical innovation. (**#3, #65**) • It is part of the market strategy of some companies to avoid open interfaces of their ICT products. (**#12, #25, #33**) • Terminology is sometimes confusing; there seem to be different expressions for the same or similar things and concepts. (Q~9) • Accessibility is one of many require-ments for a product design, e.g. a mobile phone underlies about 2500 different requirements. (Q~8)

Vision facet VFacc-4: The technology transfer process that realises accessibility in ICT

Bridges:	**Barriers**:
• There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. (**#3**) • There exist concepts for Design-for-All. (**#3**, **#28**) • There are agencies that give advice on TT, at least at some universities. (**#1**) • There is technical know-how in the Assistive ICT area that is also applicable in Accessible ICT. (#43, **#37, #88**) • Corporate social responsibility policies is an important part of companies public relation. (#83)	• Mainstream ICT companies are usually “technology driven”. (#9) • “Accessibility” is usually not regarded as a main feature of a product or service; “functionality” is regarded more important. (#77, **#3**, #9) • There is too little understanding of the crucial points in TT and how to overcome them. TT requires multi-disciplinary skills, not only technical skills. (**#1**) • Technology transfer between different research areas is complex. (**#88**) • The success of technology transfer is difficult to monitor or to evaluate. (Q~10) • Technological know-how is often a valuable asset in a company motto be shared or transferred to others. (**#88**)

Vision facet VFacc-5: Technology transfer networking between stakeholders

Bridges:	**Barriers**:
• There exist some advice centres for accessibility. (**#27**) • Publicly funded R&D projects often support or require the cooperation of end-users, academia, and industry. (**#44**)	• There are many quite different stakeholders involved in the TT chain who have different educational/ academic backgrounds and often do not speak the "same language". (**#56**, #68) • There is no global publicly inclusive infrastructure. (**#29**) • Industry is so competitive that sharing of knowledge is difficult. (Q~11) • A great part of the knowledge generated at universities gets in technology transfer to manufacturers. (Q~12)

Vision facet VFacc-6: Market and market supports

Bridges:	**Barriers**:
• There exist national and European funding programmes to support TT to the market. (**#49**)	• As long as "accessibility" is regarded as an extra feature and is not taken into account from the beginning of development, it is likely that the achievement of accessibility costs extra. (**#70, #20**) • The requirements concerning accessibility in procurement in EU member states are not well known. (**#61**) • The market potential of accessible versus not accessible products is not well known. (**#46**) • Installation and personalized configuration is crucial for accessibility – and for the consumer's acceptance of an ICT product. (Q~16) • End-users are often not well informed which available technology or technical products meet their accessibility requirements best. (Q~2) • High purchase costs for Accessible or Assistive ICT products. (SDDP2#61)

Vision facet VFacc-7: Policy to support technology transfer

Bridges:	**Barriers**:
• The UN Convention that refers to e-accessibility has been adopted in all EU states. (#69)	• The requirements concerning accessibility in procurement in EU member states are not well known. (**#42**, **#81**)

4.4.2. Bridges and barriers in technology transfer concerning Assistive ICT

Vision facet VFass-1: End-user needs that are known and respected

Bridges:	**Barriers**:
• Many studies on end-user needs (concerning people with disabilities and elderly people, and ICT) have been made; much knowledge is already there. • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (**#44**) • There are many user organisations (e.g. of people with disabilities) who can speak for their members and demand their needs. (#26, **#44**) • People with disabilities (as end-users) are usually in the direct focus of companies and organisations doing R&D in Assistive ICT. (**#44**)	• Taking into account the various abilities and disabilities of end-users, their individual needs and requirements concerning assistance vary significantly, are sometimes combined, and are sometimes contradicting. (**#1, #31**) • End-users and technical developers usually think in different categories. There is a principle problem of understanding each other. (#26)

Vision facet VFass-2: Awareness – knowledge – skills concerning Assistive ICT

Bridges:	**Barriers**:
• Much knowledge on accessibility can be derived from the Assistive Technology sector. Both fields have some principles in common and partly use the same technology (**#16**) • "Human factors" is a subject in university education. (#84, #55) • Assistive functions (in general) are gaining a positive image from mainstream premium products (e.g. cars) (#72)	• Existing knowledge in Assistive ICT is distributed and hard to collect. (#74,#57, Q~6) • Most of the people currently working in ICT have never received any education or training on accessibility issues or Assistive Technology. (**#36**, #84, #54) • Mainstream ICT companies are usually quite different from companies active in Assistive ICT. (**#16**) • There is some reluctance in using ICT products because (potential) end-users regard such products (even in the Assistive Technology area) as being complex and difficult to use. • Are there success stories? (**#71**) • Many assistive products are expensive; people with disabilities often have a low budget and cannot afford to buy all useful new Assistive ICT products. (#39) • Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the burden (time) of always learning new things without an obvious benefit for the person. – Especially true for elder people. (Q~20) • Assistive ICT is years behind the general ICT, with a tendency of a growing gap. (Q~5) • So much new technology and continuous change in ICT. Therefore there is no stable knowledge. (Q~7)

Vision facet VFass-3: Procedures – tools – methods – environments to realise Assistive ICT

Bridges:	**Barriers**:
• There exist already working groups for international standards and guidelines on accessibility of ICT. (**#3**) • There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. **(#15)**	• The elaboration of guidelines and standards is usually years behind the technical innovation. (**#3, #65**) • It is part of the market strategy of some companies to avoid open interfaces of their ICT products. (**#12, #25, #33**)

Vision facet VFass-4: The technology transfer process that realises Assistive ICT

Bridges:	**Barriers**:
• There exist concepts for Design-for-All. (**#28**) • There are agencies that give advice on TT, at least at some universities. **(#1)**	• ICT is developing very fast. New products and services appear frequently on the market while the life span of products is often rather short. (#11) • There is too little understanding of the crucial points in TT and how to overcome them. TT requires multi-disciplinary skills, not only technical skills. (**#1**) • Technology transfer between different research areas is complex. (**#88**) • The success of technology transfer is difficult to monitor or to evaluate. (Q~10) • Technological know-how is often a valuable asset in a company that shall not be shared with or transferred to others. **(#88)**

Vision facet VFass-5: Technology transfer networking between stakeholders

Bridges:	**Barriers**:
• There exist some advice centres for accessibility, Assistive Technology, or Independent Living. (**#27**) • Publicly funded R&D projects often support or require the cooperation of end-users, academia, and industry. (**#44**)	• There are many quite different stakeholders involved in the TT chain who have different educational/ academic backgrounds and often do not speak the "same language". (**#56**, #68) • There is no global publicly inclusive infrastructure. **(#29)** • Industry is so competitive that sharing of knowledge is difficult. (Q~11) • A great part of the knowledge generated at universities gets in technology transfer to manufacturers. (Q~12)

Vision facet VFass-6: Market and market supports

Bridges:	**Barriers**:
• There exist national and European funding programmes to support TT to the market. (**#49**)	• The requirements and conditions of financial support for the provision of Assistive ICT are complex and differ between the EU countries. (**#61**) • The market of Assistive Technology (including Assistive ICT) is scattered. (#50) • Installation and personalized configuration is crucial for accessibility/ usability – and for the consumer's acceptance of an Assistivae ICT product. (Q~16) • End-users are often not well informed which available technology or technical products meet their requirements best. (Q~2) • High purchase costs for Assistive ICT products. (SDDP2#61)

Vision facet VFass-7: Policy to support technology transfer

Bridges:	**Barriers**:
• There is some political awareness on the needs of people with disabilities and the political will to take care of these needs.	• The legal requirements and conditions of financial support for the provision of Assistive ICT are complex and differ between the EU countries. (**#81**, **#61**)

4.5. Identification of activities to overcome the gaps

The following lists present possible activities to overcome the gaps in TT: activities that support the existing "bridges" or build new ones, and activities that reduce or overcome existing "barriers". Furthermore the potential supportive influence between the activities are represented in an "influence map". The findings are based on the outcome of the 1st CARDIAC SDDP workshop.

4.5.1. Activities concerning technology transfer in Accessible ICT

A list of ideas for activities to support TT in Accessible ICT was a major outcome of the 1st CARDIAC SDDP workshop. Those ideas which were regarded as the most influential (during the workshop) are highlighted in the following list:

Vision facet VFacc-1: End-user needs that are known and respected

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **End-user needs that are known and respected**	**#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** #51: Learn how to sell the technology **#44: Provide incentives to bring academia, industry and users together** #22: Support users to demand accessible products and services **#31: Gain deeper understanding of personal barriers** SDDP2#55: Identify human factors barriers to health, education and participation of low income groups Q~1: End-users learn about their personal accessibility requirements. SDDP2#60: Promote common research on user needs and preferences to be used by all e-inclusion projects

Vision facet VFacc-2: Awareness – knowledge – skills concerning accessibility in ICT

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **Awareness – knowledge – skills concerning accessibility in ICT**	**#16: Increase positive contribution to fill the gap between assistive and mainstream technology** **#17: Improve education and training about inclusion of people working in industry dealing with mainstream** #84: Embedding accessibility in engineering curricula #24: Create awareness and fight discrimination **#36: To improve the knowledge of technology potential to support an inclusive life** #39: Educating people to actively use technology breakthroughs #54: The industry should be aware of the user needs of all (#55: Make basic research researchers aware of the application field of accessibility) **#71: Success stories needed** #10: Studies that demonstrate the positive contribution of Assistive and Accessible ICT #72: Positive monetary aspects #74: Access to results for a broad range of companies #57: Improve distribution of information outside the group of people working in the inclusion environment Q~1: Train end-users to well understand their personal accessibility requirements. Q~6: Improve access to detailed information. Q~7: Provide efficient means for the provision and exchange of knowledge. SDDP2#4: Design clearing house for inclusive HCI. SDDP2#42: Research on reasons why existing knowledge and standards on accessibility are not known or applied by HCI developers. SDDP2#54: Research on how to increase and widen accessibility in professional education

Vision facet VFacc-3: Procedures – tools – methods – environments to realise accessibility of ICT

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **Procedures – tools – methods – environments to realise accessibility of ICT**	**(#3: Accessibility filter in company product R&D process)** **#12: Open interfaces that allow products and services to interact** **#21: Consistent adaptable user interfaces should be mandated for EU projects** **#25: Personalization for all and open interfaces when needed** **#33: Promote interoperability of accessible products and services** SDDP2#46: Promote interoperability among devices and services to enhance accessibility **#65: Define technical interfaces between mainstream products and assistive technology products** #63: Ensure ICT reliability, robustness and security **#15: Provision of procedures, easy to use tools and environments for accessibility testing** SDDP2#26: Develop more specific and clear accessible guidelines for application developers #86: Environments for interoperability testing SDDP2#7: Promote research in methodologies and tools for HCI accessibility evaluation, including, monitoring and benchmarking SDDP2#63: Research on automated evaluation aids #35: Provide standardized technical solutions or modules for accessibility in specific domains #53: Specific methodologies and tools for the development of Accessible ICT #64: Focus on interconnectivity of technology SDDP2#29: Research methodologies that efficiently collect data about users including existing HCI quantitative tools (like needs, skills, interests, limitations) SDDP2#11: Provide tools for decision making in the user-centered design process SDDP2#10: Facilitate the creation of digital accessible materials to non accessibility experts

	Q~9: Be consistent in terminology Q~8: Regarding the great number of requirements in product design, provide engineers with exactly the information they need preferably in their language (checklists, detailed technical specification)

Vision facet VFacc-4: The technology transfer process that realises accessibility in ICT

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **The technology transfer process that realises accessibility in ICT**	#77: Promote models of rapid, iterative development for ICT **#3: Accessibility filter in company product R&D process** #9: Companies adopting accessibility philosophy in their product and service design **#28: Make it more general rather than specific accessible and assistive** **#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** Q~10: Formally monitor/ measure the success/ failure of technology transfer. #11: Realizing proof of concept is not a product or service **(#88: Instigate a mechanism to support the transfer of technology from other areas of research)** #5: Focus on novel and creative designs **#37: Improve the level of technological research in inclusion** **#7: Maximize potential user base for accessible products** **#23: Support user involvement in all phases of product life cycle** (#74: Access to results for a broad range of companies) #43: Examine how guidelines for Assistive Technology inform best mainstream ICT products and services **#62. Translate user needs into product design**

Vision facet VFacc-5: Technology transfer networking between stakeholders

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **Technology transfer networking between stakeholders**	**#56: Better understanding of the process involving research, development and technology transfer in ICT** #68: Insight into gaps in the role and responsibility among stakeholders **#27: Fund the development of broker agencies for accessible products** **#44: Provide incentives to bring academia, industry and users together** (#57: Improve distribution of information outside the group of people working in the inclusion environment) Q~12/Q~13: Improve the information transfer from research centres and universities to manufacturing organisations. **#29: Build a global public inclusive infrastructure** #30: Implement the innovation partnership on active and healthy aging (#48: Improve links with the e-health market) (#64: Focus on interconnectivity of technology) #55: Make basic research researchers aware of the application field of accessibility **#88: Instigate a mechanism to support the transfer of technology from other areas of research** SDDP2#47: Research on methodologies to analyze collaborative accessibility and undertake collaborative user- and usage centered design SDDP2#75: Create open development environments for accessibility solutions (as a platform for co-operation)

Vision facet VFacc-6: Market and market supports

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **Market and market supports**	**#70: Consumers should not pay more for accessibility** #6: Include and monitor business models when initiate development projects **#20: Offer incentives to suppliers who offer effective accessible products and services** **#46: Provide accurate potential user data to developers** **#61: Analyze procurement methods in member states** **#49: New funding mechanism to assist in exploitation - commercial introduction phase** #75: Marketing for accessible solutions #48: Improve links with the e-health market Q~2: Better inform end-users which available technology or technical products meet their accessibility requirements best. Q~14: Encourage mainstream ICT's to advertise more of the accessible features of their products to educate users. Q~15: Information of consumers, resellers and providers of assistive technologies are required. Q~16: Installation and configuration is crucial for accessibility. Q~17: Special briefing, training and instruction materials are necessary. Q~18: Provide sufficient information about the market. Q~19: Provide consistent and plausible information about the market. Q~20: Train users to use innovative products. SDDP2#55: Identify human factors barriers to health, education and participation of low income groups SDDP2#61: Explore ways to move from purchase to lease or renting Accessibility and Assistive ICT (exploring market, policy and technology challenges) SDDP2#70: Research on how to make accessibility simpler to deliver, apply, configure, support and use.

Vision facet VFacc-7: Policy to support technology transfer

Setting: **Technology transfer in Accessible ICT** **Activities to support:** **Policy to support technology transfer**	**#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** #19: Separate the three pillars of a cost benefit analysis #60: 'Green' agenda - footprint for usability #87: Harnessing the green agenda and sustainability to promote the issue of accessibility #32: Having accessibility requirements on all publicly available products and services #34: International standards must cover the needs of everybody #40: Legislate in the right place **#41: Development of open standards for Accessible ICT systems based on sound scientific data** Q~23: Harmonization in standards and guidelines, especially in non-Web technologies. **#42: Accessibility criteria in public procurement policy** #47: Make the availability of accessible technology a human right #67: Actually penalize countries, organizations and companies who don't implement accessibility and use the funds for R&D #69: Implement UN convention **#81: Consistent legislation and/or mandatory regulation in the EU countries** #83: Requirement for companies to publish their corporate social responsibility policies in respect of accessibility **#73: Small projects instead of big frameworks. Start somewhere through a pilot project to monitor easy to evaluate** #76: Simplify the approval process within the Commission before funding Q~21: Provide more funding of research projects in general. Q~22: Provide further funding of commercial projects. Q~24: Politicians should support the concept of accessibility first. SDDP2#69: Develop new mechanisms for internat. collaborations. SDDP2#71: Develop ways of sharing accessibility knowledge with developing countries.

4.5.2. Activities concerning technology transfer in Assistive ICT

Vision facet VFass-1: End-user needs that are known and respected

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **End-user needs that are known and respected**	**#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** #51: Learn how to sell the technology **#44: Provide incentives to bring academia, industry and users together** #26: Analyze user base by functional needs only **#31: Gain deeper understanding of personal barriers** SDDP2#55: Identify human factors barriers to health, education and participation of low income groups SDDP2#64: Make basic research on AT abandonment/ adoption SDDP2#60: Promote common research on user needs and preferences to be used by all e-inclusion projects

Vision facet VFass-2: Awareness – knowledge – skills concerning Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **Awareness – knowledge – skills concerning Assistive ICT**	#74: Access to results for a broad range of companies **#16: Increase positive contribution to fill the gap between assistive and mainstream technology** **#36: To improve the knowledge of technology potential to support an inclusive life** #39: Educating people to actively use technology breakthroughs (#55: Make basic research researchers aware of the application field of accessibility) #57: Improve distribution of information outside the group of people working in the inclusion environment **#71: Success stories needed** #84: Embedding accessibility in engineering curricula. #10: Studies that demonstrate the positive contribution of Assistive and Accessible ICT

	#72: Positive monetary aspects Q~6: Improve access to detailed information. Q~7: Provide efficient means for the provision and exchange of knowledge.

Vision facet VFass-3: Procedures – tools – methods – environments to realise Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **Procedures – tools – methods – environments to realise Assistive ICT**	**#12: Open interfaces that allow products and services to interact** **#65: Define technical interfaces between mainstream products and assistive technology products** **#25: Personalization for all and open interfaces when needed** #63: Ensure ICT reliability, robustness and security **#33: Promote interoperability of accessible products and services** #86: Environments for interoperability testing #64: Focus on interconnectivity of technology

Vision facet VFass-4: The technology transfer process that realises Assistive ICT

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **The technology transfer process that realises Assistive ICT**	#11: Realizing proof of concept is not a product or service **#56: Better understanding of the process involving research, development and technology transfer in ICT** **#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** #5: Focus on novel and creative designs **#37: Improve the level of technological research in inclusion** **#28: Make it more general rather than specific accessible and assistive** **#73: Small projects instead of big frameworks. Start somewhere through a pilot project to monitor easy to evaluate** **#62. Translate user needs into product design**

Vision facet VFass-5: Technology transfer networking between stakeholders

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **Technology transfer networking between stakeholders**	**#88: Instigate a mechanism to support the transfer of technology from other areas of research** **#56: Better understanding of the process involving research, development and technology transfer in ICT** #68: Insight into gaps in the role and responsibility among stakeholders **#44: Provide incentives to bring academia, industry and users together** #57: Improve distribution of information outside the group of people working in the inclusion environment #43: Examine how guidelines for assistive technology inform best mainstream ICT products and services **#29: Build a global public inclusive infrastructure** #30: Implement the innovation partnership on active and healthy aging #48: Improve links with the e-health market #55: Make basic research researchers aware of the application field of accessibility #64: Focus on interconnectivity of technology SDDP2#75: Create open development environments for accessibility solutions (as a platform for co-operation in Accessible and Assistive ICT)

Vision facet VFass-6: Market and market supports

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **Market and market supports**	#6: Include and monitor business models when initiate development projects #8: Identify and put in place rewards for market placements of products **#13: Progressive financial support to marketing assistive ICT** **#49: New funding mechanism to assist in exploitation - commercial introduction phase** #50: Understand the market dimension: local versus global #48: Improve links with the e-health market Q~2: Better inform end-users which available technology or technical products meet their requirements best. Q~15: Information of consumers, resellers and providers of assistive technologies are required. Q~16: Installation and configuration is crucial for accessibility and usability. Q~17: Special briefing, training and instruction materials are necessary. Q~18: Provide sufficient information about the market. Q~19: Provide consistent and plausible information about the market. Q~20: Train users to use innovative products. SDDP2#55: Identify human factors barriers to health, education and participation of low income groups. SDDP2#61: Explore ways to move from purchase to lease or renting Accessibility and Assistive ICT (exploring market, policy and technology challenges)

Vision facet VFass-7: Policy to support technology transfer

Setting: **Technology transfer in Assistive ICT** **Activities to support:** **Policy to support technology transfer**	**#1: A mechanism to understand where ideas fall over or go wrong in the supply chain** #19: Separate the three pillars of a cost benefit analysis #60: 'Green' agenda - footprint for usability #40: Legislate in the right place #80: Investigate whether patents are required to implement a new standard for assistive ICT. **#81: Consistent legislation and/or mandatory regulation in the EU countries** **#82: Consistency in policies for subsidies of assistive products and services.** #76: Simplify the process within the Commission before funding is approved Q~21: Provide more funding of research projects in general. Q~22: Provide further funding of commercial projects. SDDP2#69: Develop new mechanisms for international collaborations. SDDP2#71: Develop ways of sharing accessibility knowledge with developing countries.

4.6. A first plan of activities to reach the vision

4.6.1. Activities concerning technology transfer in Accessible ICT

Figure 7 shows the influence relation between the activities supporting the Technology Transfer in Accessible ICT. (For instance, an **influence relation** from activity #A to mechanism #B indicates that progress in the realisation of activity #A would have a positive / supportive influence on the realisation of activity #B.)

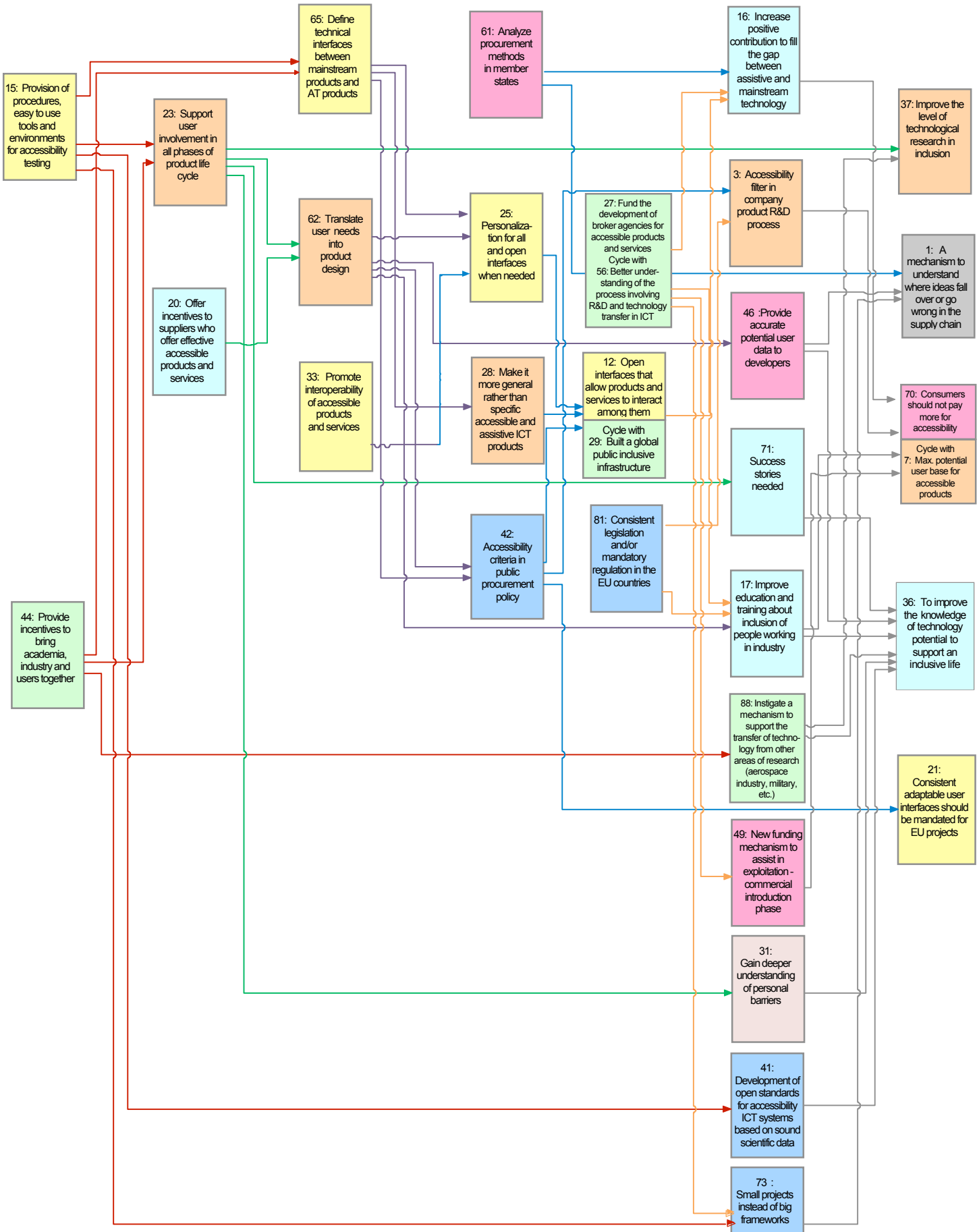


Figure 7: Influence graph of the activities supporting the Technology Transfer in Accessible ICT

Discussion of the influence graph

[See CARDIAC D2.1]

The following four mechanisms are probably the most influential and the stakeholders should give these a higher priority:

#15: Provision of procedures, easy to use tools and environments for accessibility testing

#44: Provide incentives to bring academia, industry and users together

#23: Support user involvement in all phases of product lifecycle

#20: Offer incentives to suppliers who offer effective accessible products and services

The way this graph should be interpreted is that the actions, which aim to support these four mechanisms, will have the greatest influence in achieving large-scale organizational change. Progress made in these four mechanisms will create a positive chain of facilitation because they are influencing directly or indirectly practically all mechanisms that lie above them.

The two mechanisms that lie at the root of the influence tree address improvements, which can take place within the 'environments' in which products are being envisioned and designed. Mechanism #15 calls for the need to have in place procedures and easy-to-use tools for testing products for accessibility.

Many companies lack the specialist skills to evaluate designs with disabled end-users. There is a need to provide methodologies, tools and test environments which companies can access to test their prototypes. Also they may need advice on whether their design meets any mandatory guidelines applicable in their target market. There may also be a requirement to have access to appropriate testing facilities at reasonable cost.

All too often evaluation is seen by companies as obtaining a product endorsement from a user organization, whereas it should be seen as a method of obtaining information on how to improve the design of the product.

The problem can be broken down into three aspects. First of all the 'Accessibility' of a product/service is not a feature in its own. Instead it can be regarded in relation to the person who uses the product/service, with his intentions, capabilities and his assistive tools etc., and the conditions, environment and circumstances under which the persons uses the product/service. Therefore it is practically impossible to achieve a 100% accessibility or to make a 'complete' check or proof of accessibility. Secondly, sets of "accessibility criteria" are typically abstract descriptions of certain product/service features. The more concrete they are, the more limited or incomplete they are. However, in order to be testable or checkable the criteria need to be concrete. Usually general (requirements) criteria need to be "translated" to checkable or measurable (test) criteria. Thirdly, the test criteria tend to focus on product features, neglecting the user and the application conditions.

Part of the solution could lie in:

- The provision of knowledge of test criteria (associated to requirements criteria) as well as of methodologies and procedures for testing.

- The provision of tools that support such methodologies or that directly check product features against test criteria. Ideally, some product features can be checked automatically.
- The development of test environments that could provide a suite of test tools or automated test procedures, and could simulate various environmental conditions.
- The establishment of competence centres for accessibility, which could provide a variety of trained test users, and human accessibility experts having the methodological knowledge, the necessary test tools and test environments.

An example is the area of web accessibility, where already much work has been done, on voluntary or commercial basis, where detailed requirements and test procedures have been elaborated, where legislative actions in the EU and in many countries were taken, where a number of automated tools have been developed, and where competence centres (companies, at universities, at user organizations) have been established.

This mechanism is related to “technology transfer” through the fact that the provision of the above mentioned methods and tools is a technology transfer from accessibility experts to the mainstream ICT and vice versa: new technical developments in ICT may require new accessibility test criteria, methods and tools. It is important to include the possibility to not only check final or almost final designs but to use the facility as validation tools within the iterative design process. Here a connection can be made with the activities from mechanism #23 on user involvement.

Another important point is to have procedures; easy to use tools and environments for accessibility testing that are directed also to the actors in mainstream markets. It should be easy for the actors on the mainstream markets to realize that these tools are for them and not only for a small “bubble” of assistive technology companies.

The necessity for the simultaneous involvement and collaboration of the academia is highlighted in mechanism #44. Strengthening the education of students and increasing their awareness to this field is a crucial mechanism for success. This could be promoted through the organization of seminars and invited lectures with end users, mostly in relevant faculties such as architecture, industrial design, bioengineering, computer sciences and with the participation of people with disabilities. Bridging the gap between industry and users could be achieved by not only providing really strong incentives necessary to attract the industry but also by creating an environment highlighting possibilities to make profits, by implementing a first step and building on it over time. Another approach could be to implement an IPR policy that provides clear rules and guidelines for the commercial exploitation of IP generated either within a university or research institution or by an industry stakeholder. Establishing ownership criteria and rules for income-sharing and defining responsibilities and obligations for all stakeholders could ensure the protection of intellectual property and safeguard work of each stakeholder organization. A further possibility would be to strengthen a variety of – in many cases already available – financial incentives ensuring equal participation of all stakeholders but also aiming to empower weaker parties in the equation (i.e. user groups in contrast to large corporations, etc).

Mechanism #23 calls for the importance of engaging the end-users in all phases of the product life cycle. This issue is already being addressed. For example, there have been a number of EU projects dealing with methods of user requirements analysis and user evaluation, guidelines for user involvement in R&D projects, training of users for an active involvement in R&D projects, training of users for an active involvement in standardization processes.

Various methods for simulating disabilities have also been developed; these have been useful despite their limitations but they are not the complete solution. Having direct contact with a range of people with disabilities is a better, even if time consuming, approach. Working with people with intellectual impairments may require members of the design team to learn new communication skills.

There is also still a need to educate organizations representing people with disabilities as to what can be technologically achieved and the related costs. This is a particular problem in the area of fast changing mainstream technology such as smart phones and cloud computing. Also these organizations seldom participate in discussions on priorities for future research since they lack people with the skills to understand the potential of new developments to help people with disabilities.

Knowledge therefore continues to be one of the important factors. It seems that there is already much knowledge on user involvement, but is there enough meta-knowledge (knowledge on knowledge) concerning user involvement and are all the stakeholders aware of the existing knowledge, do they know where to find it and do they know how to apply it? Another issue is how important are the issues of “user involvement” and “design-for-all” in European ICT projects outside the AT-related R&D projects? Training and mentoring is also an important aspect and should be part of the package.

The fact that this mechanism figures prominently at the foot of the influence tree indicates that this continues to be a key issue and that there is an ongoing need for measures to support the generation, provision and inter-disciplinary exchange on user knowledge and experience in the product development life cycle. If some of the previous attempts have not been wholly successful this doesn’t mean that it won’t work in future. It is necessary to re-evaluate the methodologies and try again.

Mechanism #20 expresses the need to offer incentives to suppliers who offer effective accessible products and services. Experience has shown that it is often difficult to attract large enterprises to collaborate in funded projects as they are often see it as a distraction from direct project work, they often have to contribute a large amount, either in cash or in-kind and they often have to license the technology to take to market as the SMEs often hold the new IPR. There is also a perception that funded projects are a non-direct route to market which is an additional disincentive.

It may be useful, therefore, to offer other incentives such as tax breaks, tax/innovation credits, reduced VAT on items purchased as part of an R&D project, lower National Insurance contributions for the work carried out by staff on R&D projects, etc. However, this

could be an administrative nightmare to implement in a manner that companies do not find loopholes to claim the benefit while not investing in accessibility.

Other incentives could include “Grants for Research and Development” which could help SMEs to develop ideas and sub-contract universities and other research institutes to carry out research on their behalf. Such grants could be given as a “loan” at very favourable rates or non-refundable payments if certain criteria are met, e.g. the company proving that they have made their products and/or services more accessible.

The next level in the graph that exerts great influence is are the 3 mechanisms:

- #62: Translate user needs into product design
- #65: Define technical interfaces between mainstream products and assistive technology products
- #33: Promote interoperability of accessible products and services

Idea #62 is somewhat related to idea #23 below it. Nevertheless, it addresses a slightly different perspective. Experience teaches us that the mere involvement of end-users in the phases of production is not sufficient. Users are not always able to articulate their needs or to know what is readily available that could improve a proposed product or what is in principle possible. Moreover, users find it difficult to imagine how their input could be taken into account and how it will be translated into a real product feature.

This underlines an inherent difficulty for designers to capture user needs and turn them into a set of meaningful design specifications that can be readily implemented and checked by the industrial design team.

An example could be the raised dot on the 5-key of mobile phones. From the user requirement of being able to identifying the various keys on a mobile phone, it was possible to define the specifications of a raised dot on the 5-key. However, such examples are relatively hard to find and this mechanism is therefore considered to be far from being resolved.

A typical problem is the designer of a new smart mobile phone wanting detailed specifications of what he should do to make it ‘accessible’ (this includes the hardware, resident software as well as downloadable applications). Typically there is no complete prototype before it goes into production (but there is a computer simulation). Defining what is ‘accessible’ for someone with a mild intellectual impairment is far from trivial.

One important point when translating user needs into product design is to set up guides that do not hinder further design development over time. User needs change in a changing society and new technical possibilities makes it possible to meet the needs in a more useful and intuitive way with good design.

One way of achieving this could be through a set of “best practices” that could change over time. It cannot be limited to present “best practice”. If someone wants to base a design on new thinking that is promising it should also be a way to translate user needs into design.

It is also important that the users are heavily involved in testing out new products before they are taken to the marketplace. Thus, many potential problems may be identified and corrected at an early stage.

Ideas #65 and #33 address the need to make products and services more compatible and interoperable with each other. For publicly available systems and services consumers expect the user interface to work in a consistent manner. For example a card used for ticketing on public transport may also have the capability of being used to pay for low value purchases; the consumer expects the process of using the card for the two services to be similar (including the audio signals relied on by the blind users).

The ability to adapt the user interface to suit individual preferences would make terminals easier to use by a significant number of people. These preferences could be coded on the user's card or stored in the network. For example, the European standard EN 1332-4 specifies how to code user preferences.

One limitation is the reluctance of designers to provide standard interfaces to permit disabled users to connect an assistive device to a mainstream product. This reluctance seems to come from the lack of a business case for the increase in cost of providing such an interface if it is perceived to be solely for use by disabled people. However a number of companies are developing systems to permit customers to use a mobile phone handset to access a terminal; this is primarily perceived as increasing the potential number of customers even though it could significantly help some disabled users.

This initial preliminary analysis of the ideas for Corrective Mechanisms at the foot the influence tree will conclude with the analysis of two of the mechanisms in level IV (#28 and #42).

Idea #28 addresses the issue of designing Accessible and Assistive ICT products and services as more general mainstream technology rather than technology that is specifically for elderly people or people with disabilities. The idea is that in order to improve image, increase market and enhance technology transfer and to avoid any 'Gerontophobia', assistive ICT products and services should be established as part of a general concept such as 'smart technologies', 'smart home', 'smart environment', etc, rather than as a discrete sector (technology) that is aimed at the elderly population or people with disabilities.

Idea #42 addresses the issue of accessibility criteria in public procurement. There are two particular ways in which policies on public procurement can be expected to influence the availability of goods and services that are accessible to people with disabilities and older people. Firstly, there is the direct result when the required accessibility features are demanded by the purchasing authority within the terms of contract. Secondly, there is an indirect effect through which the purchasing practices of public bodies have an influence on wider product design in the relevant industries. The magnitude of this indirect effect will vary because of differences in national purchasing approaches.

Public bodies that need to buy goods and services, whether it is for general purposes or specifically to make provision for people with disabilities, will tender for their supply. The

tender documents will usually be accompanied by a technical specification that describes the required product and forms the basis for the ensuing contract. Any accessibility features that are needed will be detailed in the specification, using published standards where they exist. In the European Union, there is a clear obligation to use European Standards where these are available, and there is also a clear requirement to consider accessibility in all public forms of tendering. When tendering for ICT equipment, to take one example, it is common practice to buy a service package rather than just the hardware, so that maintenance and updating is included in the same contract. Nevertheless, the accessibility requirements can still be set out in the contract, although this may mean that they are provided to specific need rather than being incorporated in all of the equipment delivered. This customized approach may be particularly valuable in respect of telephone extensions on private branch exchanges.

Some purchasing bodies, particularly the FCC in the USA, have a policy of purchasing only standard commercially available items, but at bulk prices. This has the effect upon the market of encouraging all manufacturers to incorporate all the required accessibility features in their products, for otherwise they would not be eligible for that purchaser's contracts. In other instances suppliers are free to design and manufacture to the contract specification, or to modify a production design by adding or removing features so as to meet the specification at a competitive price. In these cases the public purchasing will have less influence on the general availability of accessibility features and it is not unknown for a product that incorporates certain features for one market place to have them removed in another. The rationale for this is presumably to make savings in cost, weight or power consumption.

These comments upon public procurement may be applicable beyond the public sector. Large private sector organizations, which operate a central procurement facility, can achieve similar results in creating awareness and influencing behaviour among suppliers. If these organizations find that they need accessibility features to enable recruitment and retention of employees with disabilities, especially where that is a feature of national equality legislation, their purchasing practices will be a powerful influence upon the design of equipment and services.

An inherent problem with this approach is to define what is 'accessible'. In practice some features, which make a product or service accessible for one group, are detrimental for another group of potential users. Procurers and suppliers are looking for simple measurable features, which deem a product to be 'accessible'. Section 508 attempts to do this, but we need a better way of specifying the 'accessibility criteria'. Once this is done, procurement policy would significantly influence the technology transfer process.

4.6.2. Activities concerning technology transfer in Assistive ICT

Figure 8 shows the influence relation between the activities supporting the Technology Transfer in Assistive ICT.

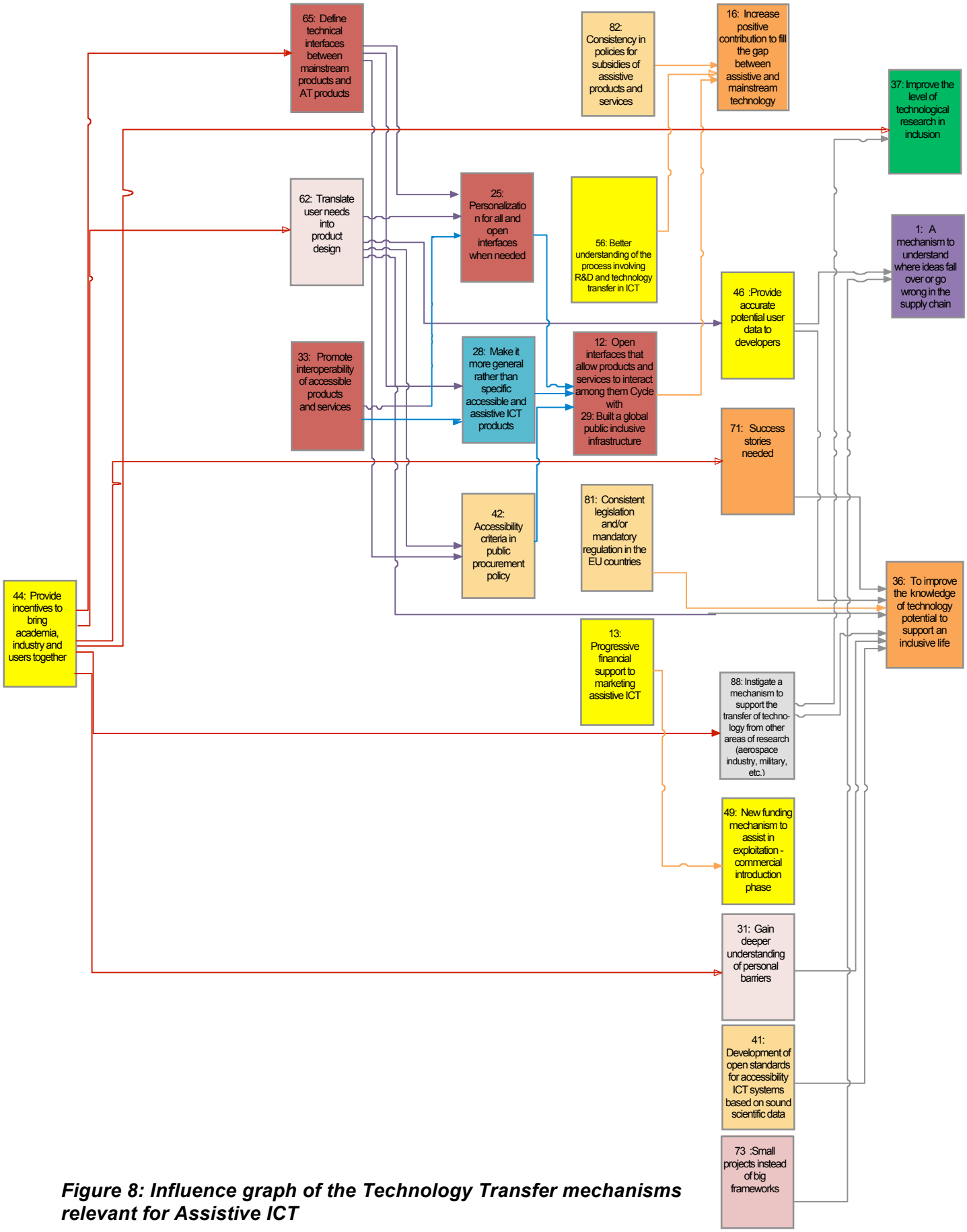


Figure 8: Influence graph of the Technology Transfer mechanisms relevant for Assistive ICT

5. A first draft roadmap to support technology transfer in Assistive and Accessible ICT

The first draft roadmap comprises the analytical findings from the previous steps of the roadmapping methodology and is composed of a small number of strategic actions, each of which is described by:

- title
- background
- a goal (related to vision)
- the supporting bridges
- the limiting barriers
- a number of sub-actions
- involved stakeholders
- kind of potential support by EU Commission

5.1. Proposed actions concerning technology transfer in Accessible ICT

5.1.1. Proposed actions – overview

1. Strengthen the role of end-users and their needs

- Explore **end-user needs** concerning accessibility in ICT and disseminate the findings
- Strengthen the **role of end-users** in the whole TT process

2. Create an infrastructure for awareness, knowledge and education on accessibility and Universal Design in ICT

- Create an **infrastructure for knowledge and education** on accessibility and Universal Design in ICT
- Build up an **awareness** of the potential and the consequences of accessibility in ICT

3. Provide instruments that facilitate the realisation of accessibility in ICT products and services

4. Establish a culture of Universal Design in ICT companies

5. Establish collaborative environments – Support the technology transfer between stakeholders concerning Accessible ICT

6. Prepare accessibility for the market – Prepare the market for accessibility

7. Practice a policy of "accessibility"

5.1.2. Proposed actions – structured description

5.1.2.1. Strengthen the role of end-users and their needs

Background

The 'accessibility' of a product or service is not a feature in its own. Instead it can be regarded in relation to the person who wants to use the product/service, with his intentions, capabilities and his assistive tools etc., and the conditions, environment and circumstances under which the persons uses the product/service.

Goals

The accessibility needs of end-users are well known and respected in mainstream ICT industries. (from VFacc-1)

End-users are enabled to take actively part in technology transfer processes. (from VFacc-1)

Supporting and limiting factors

Bridges:	**Barriers**:
• Many studies on end-user needs (concerning people with disabilities and elderly people) have been made; much knowledge is already there – in the Assistive Technology area. • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (**#44**) • There are many user organisations (e.g. of people with disabilities) who can speak for their members and demand accessibility. (#22)	• Taking into account the various abilities and disabilities of end-users, their individual needs and requirements concerning accessibility vary significantly and are sometimes combined. (**#1, #31**) • ICT is developing very fast. New products and services appear frequently on the market while the life span of products is often rather short. • People with disabilities (as end-users) are usually in the direct focus of companies and organisations doing R&D in Assistive ICT. (**#44**) • New developments in mainstream ICT are usually not driven by accessibility needs of end-users. – Typically it is the other way round: Deficits in accessibility of products are detected after market introduction; end-user needs concerning accessibility are regarded as "extra" requirements. (#51, **#44**) • End-users and technical developers usually think in different categories. There is a principle problem of

	understanding each other. (#22) • End-users have problems in knowing or expressing their personal accessiblity needs. (Q~1)

Sub-actions and involved stakeholders

Table 2: Sub-actions and stakeholders to strengthen the role of end-users and their needs

Sub-actions \ **Involved stakeholders**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Train end-users to take actively part in technical development projects, to express their needs and visions, and to check whether their needs are respected. (Q~1)	x	x				x											
Train end-users to take actively part in the development of guidelines and standardisation.	x					x			x								
Support end-users to effectively demand the accessibility of mainstream ICT products and services. (#22)	x					x	x				x						
Train product developers in effectively involving end-users (with disabilities) in the product development process.	x		x	x		x	x										
Require and support end-user involvement in (public funded) R&D projects. (**#44**)	x		x	x													
Analyse end-user needs in a systematical and comprehensive way; keep the analysis up-to-date when innovative developments are made in ICT.	x		x				x										
Analyse the supply chain and usage of existing ICT products and services by people with disabilites. Analyse where designed/intended accessibility features fail. (**#1**)	x	x	x	x			x							x			x
Analyse and get a deeper understanding of personal barriers of (potential) end-users with respect to ICT, including human factors barriers to health, education and participation of low income groups. (**#31**, SDDP2#55)	x	x	x	x			x										x
Establish “Accessibility Competence Centres”.	x		x				x	x									

Involved stakeholders / Sub-actions	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Test new ICT products and services with respect to accessibility criteria and publish the results.	x		x				x										
Promote common research on user needs and preferences to be used by all e-inclusion projects. (SDDP2#60)	x		x									x	x				
Research methodologies that efficiently collect data about users including existing HCI quantitative tools (like needs, skills, interests, limitations). (SDDP2#29)	x	x	x				x										x

Kind of potential support by EU Commission

- Require the active participation of people with disabilities in funded R&D projects which develop ICT products or services for end-users. Require that all technological innovations and developments are explicitly checked with respect to accessibility in such projects.
- Support relevant R&D projects by the gratis provision of training courses for technicians how to involve people with disabilities in R&D projects.
- Fund the development and maintenance of training courses (online and presence) for technicians how to involve people with disabilities in R&D projects. (The running/ maintenance of such courses could be done by “User Needs Competence Centres”.)
- Fund the development and maintenance of training courses (online and presence) for people with disabilities how to actively participate in R&D projects, in guidelines development, and in standardisation. (The running/ maintenance of such courses could be done by “Accessibility Competence Centres”.)
- Fund projects that analyse end-user accessibility needs, the usage, and potential personal barriers of existing ICT products/services in a systematical and comprehensive way and keep the analysis up-to-date when innovative developments are made in ICT.
- Stimulate the establishment of national or regional “Accessibility Competence Centres”. Tasks of such centres could include e.g. training courses for technicians and people with disabilities, test of new ICT products/services concerning accessibility, advice for technical developers on user accessibility needs.

5.1.2.2. Create an infrastructure for awareness, knowledge and education on accessibility and Universal Design in ICT

Background

Information & Communication Technologies develop quite fast and their applications change frequently. Even if the principle user requirements concerning accessibility remain the same, the practical accessibility requirements are usually closely related to the applied technology and change as frequently as the technology changes.

'Accessibility' is – if at all – regarded as an "extra" requirement of a mainstream product.

Knowledge on accessibility and Universal Design is multi-disciplinary.

Goal

There is a vital and dynamic domain of knowledge on "Accessibility and Design-for-all in ICT", including an infrastructure that establishes and maintains awareness in society, that provides and educates practical know-how for implementation processes, and that gains and transfers academic knowledge into applied sciences and technology. (from VFacc-2)

Supporting and limiting factors

Bridges:	**Barriers**:
• Much knowledge on accessibility can be derived from the Assistive Technology sector. (**#16**) • "Human factors" is a subject in university education. (**#17**, #84, #55) • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (#24)	• Most of the people currently working in ICT have never received any education or training on accessibility issues. (**#17, #36**, #84, #54) • Mainstream ICT companies are usually quite different from companies active in Assistive ICT. (**#16**) • Many (potential) end-users consider themselves as 'too stupid' when they cannot use ICT products and services, i.e. they see the deficit in their own ability rather than in the features of the product. (#72, #24, #54) • Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the burden (time) of always learning new things without an obvious benefit for the person. – Especially true for elder people. (Q~20)

	• Are there success stories? (**#71**) • Detailed information in certain areas is difficult to find which can restrict progress. (Q~6) • So much new technology and continuous change in ICT. Therefore there is no stable knowledge; therefore knowledge on accessibility of ICT needs to be updated frequently. (Q~7)

Sub-actions and involved stakeholders

Table 3: Sub-actions and stakeholders to create an infrastructure for awareness, knowledge and education on accessibility and Universal Design in ICT

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Study																	
Study the economical and social effects of successfully implemented and of potential Accessible ICT solutions and published the results. (#10)				x			x				x			x			x
Research on reasons why existing knowledge and standards on accessibility are not known or applied by HCI developers. (SDDP2#42)			x	x			x	x									
Create awareness																	
Make mainstream industry aware of the real market potential and the wide user base of Accessible ICT products and services. (from #18)							x				x			x	x		x
Create awareness of user needs, technical requirements, and solutions concerning accessibility in ICT in mainstream industry. (#24, #54)	x	x	x				x				x	x					
Create awareness of technology potential to support an inclusive life. (**#36**)			x	x	x		x					x			x		
Create awareness of the application field of “Accessible ICT” among researchers doing basic research. (#55)			x				x	x				x					
Define “Accessibility” as a research field on its own. (#55)			x									x					

Involved stakeholders / Sub-actions	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Demonstrate and publish																	
Publish success stories on technology transfer and the development of well Accessible ICT mainstream products/ services, including the success factors. (**#71**)				x				x				x			x		
Demonstrate to industrial companies that the accessibility of their products is a positive feature, that many customers can benefit from it, and that it can be a competitive advantage. (#72)	x		x				x				x	x					x
Publish accessibility aspects of R&D results and know-how generated in public funded projects. (#74)			x	x			x	x									
Provide sources of knowledge																	
Transfer know-how on accessibility from the Assistive Technology field to the ICT mainstream field. (#16)			x	x	x		x	x									
Establish public available sources of knowledge on accessibility and Universal Design in ICT, e.g. online-databases, training courses, advice centres. (#57, Q~6, Q~7)			x	x	x		x					x					
Design clearing house for inclusive HCI. (SDDP2#4)	x				x		x	x									x
Educate and train																	
Support and train people with disabilities to actively customize and use Accessible ICT products and services. (#39, Q~1)	x	x		x		x					x						x
Improve the education and training about inclusion and accessibility of people working in mainstream industry. (**#17**)				x		x	x										
Embed the topics of “Accessibility” and “Design-for-All” in engineering curricula and professional education. (#84, SDDP2#54)						x											

Kind of potential support by EU Commission

Study

- Fund projects that study the market potential as well as the economical and social effects of successfully implemented and of potential Accessible ICT solutions. (**#36**)

- Fund technical studies that analyse the chances, challenges, potential, limitations, and threats of upcoming ICT. (**#36**)

Create awareness

- Require the active participation of technicians in gratisly provided training courses on Accessible ICT in funded R&D projects which develop ICT for end-users.
- Require that all technological innovations and developments are explicitly checked with respect to accessibility in such ICT projects; require that accessibility is considered in market-oriented analyses, plans, forecasts etc.

Demonstrate and publish

- Stimulate and support outstanding projects to publish success stories on technology transfer and the development of well Accessible ICT mainstream products/ services, including the success factors. (**#71**)
- Select best practice examples of Accessible ICT products/services on the market; describe their accessibility features both, for technical developers and for end-users, and describe how companies and end-users benefit from those features.
- Require from public funded ICT projects/studies to publish (as far as possible) the accessibility aspects of their R&D results and related know-how.

Provide sources of knowledge

- Stimulate the establishment of national or regional “Accessibility Competence Centres”. Tasks of such centres could include e.g. training courses for technicians and people with disabilities, test of new ICT products/services concerning accessibility, advice for technical developers on user accessibility needs.
- Support the establishment and maintenance of a web-based European knowledge base on Accessible ICT and Universal Design issues. Motivate public funded ICT projects (also in the Assistive ICT field) to use and to feed such a European knowledge base in an organized manner. (**#16**)
- Require that all technological innovations and developments in funded Assistive ICT projects are explicitly checked with respect to their relation to and potential for general accessibility. (**#16**)

Educate and train

- Support relevant R&D projects by the gratis provision of training courses for technicians on necessity, requirements, know-how, and existing tools concerning Accessible ICT.
- Fund the development and maintenance of training courses (online and presence) for technicians on necessity, requirements, know-how, and existing tools concerning Accessible ICT. (The running/ maintenance of such courses could be done by “Accessibility Competence Centres”.) (**#17**)
- Stimulate (on a political level) that the topics of “Accessibility” and “Design-for-All” are considered in curricula of universities in EU countries.
- Stimulate (on a political level) that training of end-users in the usage and adaptation of modern ICT products/services is supported by local and regional authorities.

5.1.2.3. Provide instruments that facilitate the realisation of accessibility in ICT products and services

Background

Available technical solutions (including software modules, technical descriptions, guidelines, technical know-how) developed and provided by accessibility experts make it easier for ICT companies, who have no special expertise in accessibility, to achieve accessibility of their products or services. (#35)

Besides accessible HMIs applicable for the great majority of the users, there are some users who may be dependent on their customized assistive technology HW to operate various applications. Technical interfaces to Assistive Technology products could make mainstream ICT products and services accessible even to those who are dependent on such special HCI hardware. A prerequisite would be that such technical interfaces are agreed (standard) between the mainstream ICT providers and the Assistive Technology providers. (#65)

Goal

Researchers and developers of ICT have easy access to well elaborated and well described useful technical instruments that facilitate the realisation of accessibility in ICT products and services. These instruments may comprise e.g. methods, procedures, modules of software or hardware, technical descriptions, guidelines, standards, development/ test tools and environments, technical experiences and evaluations. (from VFacc-3)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist already working groups for international standards and guidelines on accessibility of ICT. (**#3**) • The provision of adaptable user-interfaces widens the range of potential customers of a product.. (**#21, #25**) • There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. (**#3**, **#15**)	• The elaboration of guidelines and standards is usually years behind the technical innovation. (**#3, #65**) • It is part of the market strategy of some companies to avoid open interfaces of their ICT products. (**#12, #25, #33**) • Terminology is sometimes confusing; there seem to be different expressions for the same or similar things and concepts. (Q~9) • Accessibility is one of many require-ments for a product design, e.g. a mobile phone underlies about 2500 different requirements. (Q~8)

Sub-actions and involved stakeholders

Table 4: Sub-actions and stakeholders to provide instruments that facilitate the realisation of accessibility in ICT products and services

Involved stakeholders / **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Technical interfaces																	
Define open interfaces that allow ICT products and services to interact. (**#12**, SDDP2#46)			x	x	x				x								
Define technical interfaces between mainstream ICT products and assistive technology products. (**#65**)			x	x	x				x								
Promote the interoperability of Accessible ICT products and services by the development of corresponding standards and guidelines. (**#33, #12**, #64, SDDP2#46)			x	x	x				x								
User interfaces																	
Develop principles for consistent adaptable user interfaces. (**#21**)	x		x	x	x												
Provide means for customization of user interfaces and open interfaces when needed. (**#25**)			x	x	x												
Methods and tools																	
Specify methodologies and tools for the development of Accessible ICT. (#53, SDDP2#7, SDDP2#11)			x	x													
Facilitate the creation of digital accessible materials to non accessibility experts. (SDDP2#10)			x	x													
Provide standardized technical solutions or modules for accessibility development in specific domains. (#35)			x	x	x												
Provide more specific and clear accessible guidelines for application developers. (SDDP2#26)			x				x										
Provide procedures, easy to use tools and environments for accessibility testing. (**#15,** SDDP2#63)			x	x			x										
Provide environments for interoperability testing. (#86)			x	x	x												
Ensure ICT reliability, robustness and security. (#63)				x													

Kind of potential support by EU Commission

Technical interfaces

- Support the development of standards and guidelines to achieve the interoperability of Accessible ICT products and services. (**#33, #12**)
- Request the implementation of technical interfaces in mainstream ICT products to assistive technology products according to existing standards. (**#65**).

User interfaces

- Support and request consistent adaptable user interfaces in funded ICT projects. (**#21**)

Methods and tools

- Support the development of methodologies and tools for the development of Accessible ICT and digital accessible materials.
- Support the development and provision of environments for testing the accessibility and interoperability of ICT products. (**#15**)
- Support the development and provision of practical methods and tools for customization of user interfaces and open interfaces in mainstream ICT products and services. (**#25**)

5.1.2.4. Establish a culture of Universal Design in ICT companies

Background

If Universal Design principles are essential in the whole product design process, then the realisation of accessibility of an ICT product or service requires no extra effort.

Goal

Companies that develop, produce or market (mainstream) ICT products and services incorporate “accessibility” as an integral aspect of their product philosophy and organise their work and business accordingly. (from VFacc-4)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. (**#3**) • There exist concepts for Design-for-All. (**#3**, **#28**) • There are agencies that give advice on TT, at least at some universities. (**#1**) • There is technical know-how in the Assistive ICT area that is also applicable in Accessible ICT. (#43, **#37, #88**) • Corporate social responsibility policies is an important part of companies public relation. (#83)	• Mainstream ICT companies are usually “technology driven”. (#9) • “Accessibility” is usually not regarded as a main feature of a product or service; “functionality” is regarded more important. (#77, **#3**, #9) • There is too little understanding of the crucial points in TT and how to overcome them. TT requires multi-disciplinary skills, not only technical skills. (**#1**) • Technology transfer between different research areas is complex. (**#88**) • The success of technology transfer is difficult to monitor or to evaluate. (Q~10) • Technological know-how is often a valuable asset in a company that shall not be shared or transferred to others. (**#88**)

Sub-actions and involved stakeholders

Table 5: Sub-actions and stakeholders to establish a culture of Universal Design in ICT companies

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Company philosophy																	
Regard “accessibility and design-for-all” as an integral part of companies philosophy of product and service design. (#9)				x													
Regard the realisation of “accessibility and design-for-all” as a corporate social responsibility. (#83)				x													
Offer only ICT products and services to end-users that are well elaborated, i.e. are well operational and meet the users’ needs so that the TT process has reached its final goal. (#11)				x													
Technology transfer																	
Train the staff in knowledge of the mechanisms of TT, of the resources for information and advice and of examples of good practice as well of common fallacies and causes for failures – with respect to accessibility and design-for-all. (#1/79, #56)				x		x	x	x		x							
Formally monitor/ measure the success/ failure of technology transfer. (Q~10)				x													
Systematically support TT from other areas of research, e.g. aerospace industry or military industry. (**(#88**)			x	x				x									
Take know-how and innovation in the field of Assistive ICT into account when developing new “accessible” mainstream ICT. This means TT from Assistive ICT to Accessible ICT. (#43,**#7**)			x	x	x			x									
Spend research efforts to achieve better accessibility. (**#37**)			x	x													
Product design																	
Support user involvement in all phases of product life cycle. (**#23**)	x	x	x	x													
Consider and translate user needs, especially concerning accessibility, into product design. (**#62**)				x			x										
Design mainstream ICT products and services with				x			x										

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
product features summarized under “accessibility” and “design-for-all”. (**#28**)																	
Apply international guidelines and standards as a kind of “accessibility filter” firstly to understand accessibility and secondly to get guidance in R&D processes. (**#3**)				x													
Provide means for customization of user interfaces and open interfaces when needed. (**#25**)			x	x			x										
Be creative and smart with respect to Universal Design. Bring innovation into accessibility features of products and services. (#5)			x	x			x										

Kind of potential support by EU Commission

Even though the philosophy and culture of an enterprise is influenced by many external factors, it is the sole responsibility of the company itself to define and to develop its mission and its way of working. Democratic parliaments and public authorities provide the framework and some infrastructure for the way of operation and the business activities, respectively; but they do not define directly the corporate philosophy.

Therefore the potential support by public authorities in general, and the EU Commission in particular, for “establishing a culture Universal Design in ICT companies” can only be indirect and is summarized under the other six “proposed actions concerning technology transfer in Accessible ICT”.

5.1.2.5. Establish collaborative environments – Support the technology transfer between stakeholders concerning Accessible ICT

Background

Cooperation is an essential success factor in technology transfer. Typically the producers, the distributors/ multiplies, and the users of technological knowhow are different entities. Furthermore, "accessibility" of ICT has different aspects covered by different academic disciplines, e.g. human factors, psychology, computer science, cognitive science; and there are numerous application fields of ICT, e.g. e-shopping, e-learning, e-health, e-government.

Goal

The potential stakeholders of technology transfer in Accessible ICT closely cooperate in their activities to achieve an effective technology transfer. (from VFacc-5)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist some advice centres for accessibility. (**#27**) • Publicly funded R&D projects often support or require the cooperation of end-users, academia, and industry. (**#44**)	• There are many quite different stakeholders involved in the TT chain who have different educational/ academic backgrounds and often do not speak the "same language". (**#56**, #68) • There is no global publicly inclusive infrastructure. (**#29**) • Industry is so competitive that sharing of knowledge is difficult. (Q~11) • A great part of the knowledge generated at universities gets in technology transfer to manufacturers. (Q~12)

Sub-actions and involved stakeholders

Table 6: Sub-actions and stakeholders to establish collaborative environments

Sub-actions \ **Involved stakeholders**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Train and inform potential stakeholders to achieve a better understanding of the process involving research, development and technology transfer in Accessible ICT. (**#56**)	x	x	x	x	x	x	x	x	x	x							
Establish broker agencies that support the technology transfer of Accessible and Assistive ICT. (**#27**)							x	x		x							
Create open development environments for accessibility solutions (as a platform for co-operation). (SDDP2#75, SDDP2#47)	x		x	x	x			x									
Personally meet with the different stakeholders of TT in Accessible ICT, including people from academia and industry as well as users. (**#44,** Q~12, Q~13)	x	x	x	x	x	x	x	x	x	x							
Support the information exchange between researchers and developers from different technological areas (which are typically not related or are not used to cooperate among each other) in order to identify potential synergies and to avoid redundancy. (**#44, #88**)			x	x			x	x									
Bring basic research researchers together with people of the application field of accessibility. (#55)			x	x			x	x									
Cooperate with other initiatives to improve technology transfer processes in related application fields, e.g. the innovation partnership on active and healthy aging. (#30)			x	x	x		x	x									
Cooperate with stakeholders of developing applications fields of ICT, e.g. the e-health, e-government, e-learning. (#48)			x	x	x		x	x									
Build a global public inclusive infrastructure. (**#29**)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Kind of potential support by EU Commission

- Stimulate and fund the establishment of “broker agencies” that support the technology transfer of Accessible and Assistive ICT.
- Provide incentives to bring academia, industry and users together.
- Stimulate and fund the establishment of open development environments for accessibility solutions (as a platform for co-operation)
- Require the involvement of accessibility experts in funded European ICT projects, e.g. in e-health, e-government or e-learning.
- Foster the idea of a global public inclusive infrastructure.

5.1.2.6. Prepare accessibility for the market – Prepare the market for accessibility

Background

Although market and business issues are not regarded as being part of the technology transfer process itself, they have some influence on technology transfer which is often guided by commercial considerations.

A strong market demand for “accessibility of ICT products” or for “Accessible ICT products” can stimulate and direct technology transfer and finally contributes to the financing of technology transfer.

Vice versa, the improved accessibility of ICT products and services can stimulate the market by addressing and reaching a greater number of potential customers.

Goal

The technology transfer reaches its final goal: All mainstream ICT products and services which are offered to customers or are provided to end-users have a high degree of accessibility. (from VFacc-6)

Consumers should not pay more for accessibility. (**#70**)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist national and European funding programmes to support TT to the market. (**#49**)	• As long as “accessibility” is regarded as an extra feature of a product and is not taken into account from the beginning of the development process, it is likely that the achievement of accessibility costs extra money. (**#70, #20**) • The requirements concerning accessibility in procurement in EU member states are not well known. (**#61**) • The market potential of accessible versus not accessible products is not well known. (**#46**) • Installation and personalized configuration is crucial for accessibility – and for the consumer’s acceptance of an ICT product. (Q~16) • End-users are often not well informed which available technology or technical

	products meet their accessibility requirements best. (Q~2) • High purchase costs for Accessible or Assistive ICT products. (SDDP2#61)

Sub-actions and involved stakeholders

Table 7: Sub-actions and stakeholders to prepare accessibility and the market

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Create an EU market place for ICT accessibility: products and services including technological knowhow and advice, training, information, technical solutions, development & test environments etc.				x		x	x	x			x			x	x	x	x
Collect and analyse market data, consumers, resellers and providers of Assistive technologies. (Q~15, Q~18, Q~19, SDDP2#55)				x	x									x			x
Ensure that the installation and configuration of ICT products and services is well done with respect to accessibility; provide special briefing, training and instruction materials. (Q~16, Q~17)				x	x		x				x						x
Train users to use innovative ICT products. (Q~20)	x			x	x	x	x										x
Analyze procurement methods in member states. (**#61**)											x						x
Harmonize accessibility requirements in public procurement of ICT products and services among member states.											x	x	x				
Explore ways to move from purchase to lease or renting Accessibility and Assistive ICT; research on how to make accessibility simpler t o deliver, apply, configure, support and use (SDDP2#61, SDDP2#70)				x	x		x				x			x			x
Analyse the market potential by increased/improved accessibility of mainstream ICT products and services. Provide accurate potential user data, including end-user needs, potential size of market demand, marketing requirements, service provision requirements, public procurement etc.. (**#46, #61**)	x			x							x			x			x
Inform customers or end-users on the accessibility of mainstream ICT products and services. (Q~2)	x			x													x

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Create a certified quality label for “certified accessibility”, including the necessary infrastructure.	x			x			x		x						x		
Market the “accessibility” of a mainstream ICT product as a quality feature. (#75, Q~14)				x													
Improve links to growing markets with strong ICT involvement, e.g. the e-health market. (#48)				x			x	x									
Offer incentives to suppliers who offer effective accessible products and services to the public. (**#20**)												x	x				x
Fund or support the commercial introduction of innovative accessible mainstream ICT products. (**#49**)												x	x				

Kind of potential support by EU Commission

- Foster the harmonization of accessibility requirements in public procurement of ICT products and services among EU member states.
- Fund the analysis of the market potential by increased/improved accessibility of mainstream ICT products and services, including potential end-user needs, end-user data, potential size of market demand, marketing requirements, service provision requirements, public procurement etc. in EU member states. (**#46, #61**)
- Foster user-oriented product information concerning the accessibility of mainstream ICT products and services.
- Foster the creation of a certified quality label for “certified accessibility”, including the necessary infrastructure.
- Foster the creation of an EU market place for ICT accessibility: products and services including technological knowhow and advice, training, information, technical solutions, development & test environments etc.
- Require in business plans of funded development projects on ICT to declare how “accessibility” will be marketed.

5.1.2.7. Practice a policy of “accessibility”

Background

The UN Convention on the Rights of Persons with Disabilities demands the opportunity of a full and effective participation and inclusion in society. This includes the accessibility of mainstream ICT products and services. It is the task of politicians to set the framework and to give direction for the realisation of accessibility in ICT.

Goal

Society, public bodies and political organisations not only request “Universal Design” and “accessibility” of ICT for people with disabilities and elder people, but actively support its implementation. (from VFacc-7)

Supporting and limiting factors

Bridges:	**Barriers**:
• The UN Convention that refers to e-accessibility has been adopted in all EU states. (#69)	• The requirements concerning accessibility in procurement in EU member states are not well known. (**#42**, **#81**)

Sub-actions and involved stakeholders

Table 8: Sub-actions and stakeholders to practice a policy of "accessibility"

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Implement public procurement requirements on ICT products and services that reflect end-user needs concerning accessibility. (**#1**/#79)											x		x				
Apply clear accessibility criteria in public rocurement policy. (**#42**)											x						
Foster consistent legislation and/or mandatory regulation concerning ICT accessibility in the EU countries (**#81**, Q~23)												x	x				
Besides the economic value, regard the social value of Assistive and Accessible ICT in political decisions. (#19)												x	x				
Impose accessibility requirements on all publicly available mainstream ICT products and services. (#32)												x	x				
Include the aspect "accessibility" in international standardization in the area of ICT. (#34)									x								
Foster the development of open standards for Accessible ICT systems that shall be based on sound scientific and up-to-date data. The standards shall not contradict each other. (**#41**)				x					x								
Push the full implementation of the UN Convention that refers to e-accessibility in all EU states. (#69)											x	x	x				
Publish the corporate social responsibility policies in respect of accessibility. (#83)				x													
Regard the "accessibility" of mainstream ICT as a human right. (#47)				x							x	x	x				
Fund research and development projects on Accessible ICT. (Q~21, Q~22)			x	x								x	x				

Kind of potential support by EU Commission

- Well coordinate consistent public procurement requirements on ICT products and services that reflect end-user needs concerning accessibility in the EU. (**#1**/#79)
- Well coordinate and harmonize consistent legislation and mandatory regulations in the EU with respect to the accessibility of ICT systems. (#40, **#81**, Q~23)
- Besides the economic value, regard the social value of Assistive and Accessible ICT in political decisions. (#19)
- Foster the development of a 'green' agenda for accessibility of ICT. (#60, #87)
- Ensure that countries, organisations and companies implement accessibility in ICT, especially if they receive public funds for R&D. (#67)
- Fund small, practical and goal-oriented projects in Accessible ICT; application and funding procedures should be simple. (**#73**, #76, Q~21, Q~22)
- Develop new mechanisms for international collaborations; develop ways of sharing accessibility knowledge with developing countries. (SDDP2#69, SDDP2#71)
- Use consistent terminology.
- Be an example of best practice! – Fully implement accessibility in all ICT services provided by the European Commission to the public. (Q~24)

5.2. Proposed actions concerning technology transfer in Assistive ICT

5.2.1. Proposed actions – overview

1. Strengthen the role of end-users and their needs

- Explore **end-user needs** and potential barriers concerning the use of Assistive ICT and disseminate the findings
- Strengthen the **role of end-users** in the whole TT process

2. Create an infrastructure for awareness, knowledge and education on Assistive Technology in the context of ICT

- Create an **infrastructure for knowledge and education** on Assistive Technology in ICT
- Build up an **awareness** of the potential and the demands of ICT with respect to Assistive Technology

3. Provide instruments that facilitate the realisation of assistive products and services for or by the application of ICT

4. Establish a culture of Technology Transfer in Assistive ICT companies

5. Establish collaborative environments – Support the technology transfer between stakeholders concerning Assistive ICT

6. Prepare Assistive ICT for the market – Prepare the market for Assistive ICT

7. Practice a policy for "Assistive Technology"

5.2.2. Proposed actions – structured description

5.2.2.1. Strengthen the role of end-users and their needs

Background

ICT provide great changes to develop assistive devices for people with disabilities and elderly people if their needs are known and respected.

Goal

The needs of people with disabilities for technical (ICT) means, e.g. tools, devices, software, or services, that help to overcome barriers that are well known and respected in Assistive ICT industries. (from VFass-1)

End-users with disabilities are enabled to take actively part in technology transfer processes. (from VFass-1)

Supporting and limiting factors

Bridges:	**Barriers**:
• Many studies on end-user needs (concerning people with disabilities and elderly people, and ICT) have been made; much knowledge is already there. • When R&D or TT is funded with public money then the determination of end-users' accessibility needs and the compliance with accessibility requirements can be made mandatory. (**#44**) • There are many user organisations (e.g. of people with disabilities) who can speak for their members and demand their needs. (#26, **#44**) • People with disabilities (as end-users) are usually in the direct focus of companies and organisations doing R&D in Assisitve ICT. (**#44**)	• Taking into account the various abilities and disabilities of end-users, their individual needs and requirements concerning assistance vary significantly, are sometimes combined, and are sometimes contradicting. (**#1, #31**) • End-users and technical developers usually think in different categories. There is a principle problem of understanding each other. (#26)

Sub-actions and involved stakeholders

Table 9: Sub-actions and stakeholders to strengthen the role of end-users and their needs

Involved stakeholders / Sub-actions	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Train end-users with disabilities to take actively part in technical development projects, to express their needs and visions, and to check whether their needs are respected.	x	x				x											
Train end-users with disabilities to take actively part in the development of guidelines and standardisation.	x					x			x								
Support end-users to effectively demand Assistive ICT products and services. (#22)	x					x	x										
Train product developers in effectively involving end-users (with disabilities) in the product development process.	x		x		x	x	x										
Require and support end-user involvement in (public funded) R&D projects. (**#44**)	x		x		x												
Analyse disabled end-users' needs in a broad, systematical and comprehensive way; keep the analysis up-to-date when innovative developments are made in ICT. (#26)	x		x		x		x										x
Analyse the supply chain and usage of existing Assistive ICT products and services by people with disabilites. Analyse where designed/intended accessibility features fail. (**#1,** SDDP2#64)	x	x	x		x		x							x			x
Analyse and get a deeper understanding of problems (potential) end-users face in the usage of Assistive ICT products; identify human factors barriers to health, education and participation of low income groups. (**#31**, SDDP2#55)	x	x	x		x		x										x
Promote common research on user needs and preferences to be used by all e-inclusion projects. (SDDP2#60)	x		x		x							x	x				
Establish and support "Assistive ICT Competence Centres".	x		x				x	x									
Test new Assistive ICT products and services with respect to usability criteria and publish the results.	x		x				x										x

Kind of potential support by EU Commission

- Require the active participation of people with disabilities in funded R&D projects which develop Assistive ICT products or services for end-users. Require that all technological innovations and developments are explicitly checked with respect to potential benefit for not disabled people.
- Support relevant R&D projects by the gratis provision of training courses for technicians how to involve people with disabilities in R&D projects.
- Fund the development and maintenance of training courses (online and presence) for technicians how to involve people with disabilities in R&D projects. (The running/ maintenance of such courses could be done by “User Needs Competence Centres”.)
- Fund the development and maintenance of training courses (online and presence) for people with disabilities how to actively participate in R&D projects, in guidelines development, and in standardisation. (The running/ maintenance of such courses could be done by “User Needs Competence Centres”.)
- Fund projects that analyse end-user accessibility needs, the usage, and potential personal barriers of existing Assistive ICT products/services in a systematical and comprehensive way and keep the analysis up-to-date when innovative developments are made in ICT.
- Stimulate the establishment of national or regional “User Needs Competence Centres”. Tasks of such centres could include e.g. training courses for technicians and people with disabilities, test of new ICT products/services concerning usability, advice for technical developers on user needs.

5.2.2.2. Create an infrastructure for awareness, knowledge and education on Assistive Technology in the context of ICT

Background

Assistive Technology is a very special field of applied sciences and technology; typically different disciplines, technical and non-technical ones, are involved.

Goal

There is a vital domain of knowledge on "Assistive Technology in the context of ICT", including an infrastructure that establishes and maintains awareness in society, that provides and educates practical know-how for implementation processes, and that gains and transfers academic knowledge into applied sciences and technology. (from VFass-2)

Supporting and limiting factors

Bridges:	**Barriers**:
• Much knowledge on accessibility can be derived from the Assistive Technology sector. Both fields have some principles in common and partly use the same technology (**#16**) • "Human factors" is a subject in university education. (#84, #55) • Assistive functions (in general) are gaining a positive image from mainstream premium products (e.g. cars) (#72)	• Existing knowledge in Assistive ICT is distributed and hard to collect. (#74,#57, Q~6) • Most of the people currently working in ICT have never received any education or training on accessibility issues or Assistive Technology. (**#36**, #84, #54) • Mainstream ICT companies are usually quite different from companies active in Assistive ICT. (**#16**) • There is some reluctance in using ICT products because (potential) end-users regard such products (even in the Assistive Technology area) as being complex and difficult to use. • Are there success stories? (**#71**) • Many assistive products are expensive; people with disabilities often have a low budget and cannot afford to buy all useful new Assistive ICT products. (#39) • Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the burden (time) of always learning new

	things without an obvious benefit for the person. – Especially true for elder people. (Q~20) • Assistive ICT is years behind the general ICT, with a tendency of a growing gap. (Q~5) • So much new technology and continuous change in ICT. Therefore there is no stable knowledge. (Q~7)

Sub-actions and involved stakeholders

Table 10: Sub-actions and stakeholders to create an infrastructure for awareness, knowledge and education on Assistive Technology in the context of ICT

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Study																	
Study the economical and social effects of successfully implemented and of potential Assistive ICT solutions and published the results. (#10)					x		x				x			x			x
Create awareness																	
Make mainstream industry aware of the market potential and the user base of Assistive ICT products and services. (from #18)							x				x			x	x		x
Create awareness of user needs, technical requirements, and solutions concerning Assistive ICT in mainstream industry. (#24, #54)	x	x	x				x				x	x					
Create awareness of technology potential to support an inclusive life. (**#36**)			x	x	x		x					x			x		
Create awareness of the application field of “Assistive ICT” among researchers doing basic research. (#55)			x				x	x				x					
Define “Assistive Technology” as a research field on its own. (#55)			x									x					
Demonstrate and publish																	
Publish success stories on technology transfer and					x			x				x			x		

Involved stakeholders / Sub-actions	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
the development of Assistive ICT products/ services, including the success factors. (**#71**)																	
Demonstrate to industrial companies that “assistive” functions in their products would be a positive feature, that customers could benefit from it, and that it could be a competitive advantage. (#72)	x		x	x			x				x	x					x
Publish “assistive” aspects of R&D results and know-how generated in public funded projects. (#74)			x	x	x		x	x									
Provide sources of knowledge																	
Transfer know-how on accessibility assistive functionality between the Assistive Technology field and the ICT mainstream field. (**#16**)			x	x	x		x	x									
Establish public available sources of knowledge on accessibility and Universal Design in ICT, e.g. online-databases, training courses, advice centres. (#57, Q~6, Q~7)			x		x		x					x					
Educate and train																	
Support and train people with disabilities to actively customize and use Assistive ICT products and services. (#39)	x	x			x	x											x
Embed the topics of “Accessibility” and “Assistive Technology” in engineering curricula. (#84)						x											

Kind of potential support by EU Commission

Study

- Fund projects that study the market potential as well as the economical and social effects of successfully implemented and of potential Assistive ICT solutions. (#10, **#36**)
- Fund technical studies that analyse the chances, challenges, potential, limitations, and threats of upcoming ICT for Assistive Technology. (**#36**)

Create awareness

- Require that all technological innovations and developments of Assistive ICT in funded R&D projects are explicitly checked whether they could contribute also to a more general accessibility in ICT.

Demonstrate and publish

- Stimulate and support outstanding projects to publish success stories on technology transfer and the development of Assistive ICT products/ services, including the success factors. (**#71**)
- Select best practice examples of Assistive ICT products/services on the market; describe their assistive features both, for technical developers and for end-users, and describe how end-users benefit from those features.
- Require from public funded Assistive ICT projects/studies to publish (as far as possible) the assistive functionality aspects of their R&D results and related know-how.

Provide sources of knowledge

- Stimulate the establishment of national or regional “Assistive Technology Competence Centres”. Tasks of such centres could include e.g. training courses for technicians and people with disabilities, test of new Assistive ICT products/services concerning usability, advice for technical developers on user needs.
- Support the establishment and maintenance of a web-based European knowledge base on Assistive and Accessible ICT issues. Motivate public funded ICT projects (also in the Assistive ICT field) to use and to feed such a European knowledge base in an organized manner. (**#16**)
- Require that all technological innovations and developments in funded Accessible ICT projects are explicitly checked with respect to their potential for Assistive Technology. (**#16**)

Educate and train

- Support relevant R&D projects by the gratis provision of training courses for technicians on necessity, requirements, know-how, and existing tools concerning Assistive ICT.
- Fund the development and maintenance of training courses (online and presence) for technicians on necessity, requirements, know-how, and existing tools concerning Assistive ICT. (The running/ maintenance of such courses could be done by “Assistive Technology Competence Centres”.) (**#17**)
- Stimulate (on a political level) that the topics of “Assistive Technology” are considered in curricula of universities in EU countries.

5.2.2.3. Provide instruments that facilitate the realisation of assistive products and services by the application of ICT

Background

Most of the companies developing Assistive ICT products or services are small companies. Due to the multi-disciplinary character of Assistive Technology development and the strict technical and legal requirements for such products, it is especially hard for small companies to take care of everything. The availability of effective instruments for product development would significantly improve their ability to focus on innovation.

Goal

Researchers and developers of Assistive Technology have easy access to well elaborated and well described useful technical instruments that facilitate the realisation of Assistive ICT products and services. These instruments may comprise e.g. methods, procedures, modules of software or hardware, technical descriptions, guidelines, standards, development/test tools and environments, technical experiences and evaluations. (from VFass-3)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist already working groups for international standards and guidelines on accessibility of ICT. (**#3**) • There exist already guidelines for accessibility of ICT products and test tools for accessibility testing of web pages. **(#15)**	• The elaboration of guidelines and standards is usually years behind the technical innovation. (**#3, #65**) • It is part of the market strategy of some companies to avoid open interfaces of their ICT products. (**#12, #25, #33**)

Sub-actions and involved stakeholders

Table 11: Sub-actions and stakeholders to provide instruments that facilitate the realisation of assistive products and services by the application of ICT

Involved stakeholders **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Technical interfaces																	
Define open interfaces that allow ICT products and services to interact. (**#12**)			x	x	x				x								
Define technical interfaces between mainstream ICT products and Assistive Technology products. (**#65**)			x	x	x				x								
Promote the interoperability of Assistive ICT products and services by the development of corresponding standards and guidelines. (**#33, #12**, #64)			x	x	x				x								
User interfaces																	
Develop principles for adaptable user interfaces. (**#21**)	x		x	x	x												
Provide means for customization of user interfaces and open interfaces when needed. (**#25**)			x	x	x												
Methods and tools																	
Specify methodologies and tools for the development of Assistive ICT. (#53)			x		x												
Provide procedures, easy to use tools and environments for usability testing of Assistive ICT products and services. (**#15**)			x		x		x										
Provide environments for interoperability testing. (#86)			x	x	x												
Ensure reliability, robustness and security of Assistive ICT. (#63)					x												

Kind of potential support by EU Commission

Technical interfaces

- Support the development of standards and guidelines to achieve the interoperability of Assistive ICT and of mainstream ICT products and services. (**#33, #12**)
- Request the implementation of technical interfaces in Assistive ICT products to mainstream ICT products according to existing standards. (**#65**).

User interfaces

- Support and request adaptable user interfaces in funded Assistive ICT projects. (**#21**)

Methods and tools

- Support the development of methodologies and tools for the development of Assistive ICT.
- Support the development and provision of environments for testing the usability and interoperability of Assistive ICT products. (**#15**)
- Support the development and provision of practical methods and tools for customization of user interfaces and open interfaces in Assistive ICT products and services. (**#25**)

5.2.2.4. Establish a culture of Technology Transfer in Assistive ICT companies

Background

Innovation in Assistive Technology, as a field of applied science and technology, lives from the transfer of innovative technology from other technical fields and from the user-oriented and application-oriented (innovative) combination of various technologies.

Goal

Companies that develop, produce or market Assistive ICT products and services incorporate technology transfer as an integral aspect of their company philosophy and organise their work and business accordingly. (from VFass-4)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist concepts for Design-for-All. (**#28**) • There are agencies that give advice on TT, at least at some universities. **(#1)**	• ICT is developing very fast. New products and services appear frequently on the market while the life span of products is often rather short. (#11) • There is too little understanding of the crucial points in TT and how to overcome them. TT requires multi-disciplinary skills, not only technical skills. (**#1**) • Technology transfer between different research areas is complex. (**#88**) • The success of technology transfer is difficult to monitor or to evaluate. (Q~10) • Technological know-how is often a valuable asset in a company that shall not be shared with or transferred to others. **(#88)**

Sub-actions and involved stakeholders

Table 12: Sub-actions and stakeholders to establish a culture of Technology Transfer in Assistive ICT companies

Involved stakeholders / **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Company philosophy																	
Offer only ICT products and services to end-users that are well elaborated, i.e. are well operational and meet the users' needs so that the TT process has reached its final goal. (#11)					x												
Technology transfer																	
Train the staff in knowledge of the mechanisms of TT, of the resources for information and advice and of examples of good practice as well of common fallacies and causes for failures – with respect to Assistive ICT. (#1/79, #56)					x	x	x	x		x							
Systematically support TT from other areas of research, e.g. aerospace industry or military industry. (**#88**)			x		x			x									
Take know-how and innovation in the field of mainstream ICT into account when developing new Assistive ICT. (#43,**#7**)			x	x	x			x									
Spend research efforts to achieve better technological solutions to support inclusion. (**#37**)			x		x												
Product design																	
Support user involvement in all phases of product life cycle. (**#23**)	x	x	x		x												
Consider and translate user needs into product design. (**#62**)					x		x										
Convert designs of Assistive ICT products and services to solutions "designed-for-all". (**#28**)					x		x										
Be creative and smart. Bring innovation into assistive features of products and services. (#5)			x		x		x										

Kind of potential support by EU Commission

Even though the philosophy and culture of an enterprise is influenced by many external factors, it is the sole responsibility of the company itself to define and to develop its mission and its way of working. Democratic parliaments and public authorities provide the framework and some infrastructure for the way of operation and the business acivities, respectively; but they do not define directly the corporate philosophy.

Therefore the potential support by public authorities in general, and the EU Commission in special, for “establishing a culture technology transfer in Assistive ICT companies” can only be indirect and is summarized under the other six “proposed actions concerning technology transfer in Assistive ICT”.

5.2.2.5. Establish collaborative environments – Support the technology transfer between stakeholders concerning Assistive ICT

Background

Cooperation is an essential success factor in technology transfer. Typically the producers, the distributors/ multiplies, and the users of technological knowhow are different entities. Furthermore, “Assistive Technology / Assistive ICT” has different aspects covered by different academic disciplines, e.g. human factors, psychology, computer science, cognitive science; and there are numerous application fields of ICT, e.g. e-shopping, e-learning, e-health, e-government.

Goal

The potential stakeholders of technology transfer in Assistive ICT closely cooperate in their activities to achieve an effective technology transfer. (from VFass-5)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist some advice centres for accessibility, Assistive Technology, or Independent Living. (**#27**) • Publicly funded R&D projects often support or require the cooperation of end-users, academia, and industry. (**#44**)	• There are many quite different stakeholders involved in the TT chain who have different educational/ academic backgrounds and often do not speak the “same language”. (**#56**, #68) • There is no global publicly inclusive infrastructure. **(#29)** • Industry is so competitive that sharing of knowledge is difficult. (Q~11) • A great part of the knowledge generated at universities gets in technology transfer to manufacturers. (Q~12)

Sub-actions and involved stakeholders

Table 13: Sub-actions and stakeholders to establish collaborative environments in Assistive ICT

Involved stakeholders / **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Train and inform potential stakeholders to achieve a better understanding of the process involving research, development and technology transfer in Accessible ICT. (**#56**)	x	x	x	x	x	x	x	x	x	x							
Establish broker agencies that support the technology transfer of Accessible and Assistive ICT. (**#27**)							x	x		x							
Create open development environments for accessibility solutions (as a platform for co-operation). (SDDP2#75)	x		x	x	x			x									
Personally meet with the different stakeholders of TT in Assistive ICT, including people from academia and industry as well as users. Get to know each others interests (**#44**, #68)	x	x	x	x	x	x	x	x	x	x							
Support the information exchange between researchers and developers from different technological areas (which are typically not related or are not used to cooperate among each other) in order to identify potential synergies and to avoid redundancy. (**#44, #88**)			x	x	x		x	x									
Closely cooperate with mainstream ICT industries to transfer knowhow and to ensure interconnectivity of technology. (#43, #64)			x	x	x			x									
Bring basic research researchers together with people of the application field of Assistive ICT. (#55)			x		x		x	x									
Cooperate with other initiatives to improve technology transfer processes in related application fields, e.g. the innovation partnership on active and healthy aging. (#30)			x	x	x		x	x									
Cooperate with stakeholders of developing applications fields of ICT, e.g. the e-health, e-government, e-learning. (#48)			x	x	x		x	x									
Share the special knowledge of the “inclusion community” with people outside this community. (#57)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Build a global public inclusive infrastructure. (**#29**)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Kind of potential support by EU Commission

- Stimulate and fund the establishment of “broker agencies” that support the technology transfer of accessible and Assistive ICT.
- Provide incentives to bring academia, industry and users together.
- Require the involvement of Assistive Technology experts in funded European ICT projects that are of high interest for people with disabilities, e.g. in e-health, e-government or e-learning.
- Foster the idea of a global public inclusive infrastructure.

5.2.2.6. Prepare Assistive ICT for the market – Prepare the market for Assistive ICT

Background

Although market and business issues are not regarded as being part of the technology transfer process itself, they have some influence on technology transfer which is often guided by commercial considerations.

A strong market demand for new and innovative "Assistive ICT products and services" can stimulate and direct technology transfer and finally contributes to the financing of technology transfer.

Significant innovation in Assistive ICT products and services can stimulate also the market of accessible mainstream ICT by addressing and reaching a greater number of potential customers with disabilities.

At the moment, the market for Assistive ICT in Europe is rather a local than a global one. (#50) It is highly fragmented.

Goal

The technology transfer reaches its final goal: New and innovative Assistive ICT products and services are offered to customers. (from VFass-6)

Supporting and limiting factors

Bridges:	**Barriers**:
• There exist national and European funding programmes to support TT to the market. (**#49**)	• The requirements and conditions of financial support for the provision of Assistive ICT are complex and differ between the EU countries. (**#61**) • The Assistive Technology market (incl. Assistive ICT) is scattered. (#50) • Installation and personalized configuration is crucial for accessibility/ usability – and for the consumer's acceptance of an Assistivae ICT product. (Q~16) • End-users are often not well informed which available technology or technical products meet their requirements best. (Q~2) • High purchase costs for Assistive ICT products. (SDDP2#61)

Sub-actions and involved stakeholders

Table 14: Sub-actions and stakeholders to prepare Assistive ICT and the market

Involved stakeholders / **Sub-actions**	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Create an EU market place for Assistive ICT: products and services including technological knowhow and advice, training, information, technical solutions, development & test environments etc.				x	x	x	x	x			x			x	x	x	x
Collect and analyse market data, consumers, resellers and providers of Assistive technologies. (Q~15, Q~18, Q~19, SDDP2#55)					x									x			x
Ensure that the provision and configuration of Assistive ICT products and services is well done; provide special briefing, training and instruction materials. (Q~16, Q~17)					x		x										x
Train users to use innovative Assistive ICT products. (Q~20)	x				x	x	x										x
Develop and apply practical mechanisms to monitor and evaluate business models in public funded projects in the area of Assistive ICT. (#6)					x							x		x	x		
Work towards a global, at least European, market for Assistive ICT. (#50)					x						x	x	x				
Analyse the chances and potential barriers in bringing new Assistive ICT to the market. (#50)					x							x		x	x		
Explore ways to move from purchase to lease or renting Assistive ICT. (SDDP2#61)					x									x			x
Improve links to growing markets with strong ICT involvement, e.g. the e-health market. (#48)				x			x	x									
Progressively financially support the product development of innovative Assistive ICT until marketing. (#8, #13)					x							x					
Fund or support the commercial introduction of innovative Assistive ICT products. (#8, **#49**)												x	x				

Kind of potential support by EU Commission

- Foster the creation of an EU market place for Assistive ICT: products and services including technological knowhow and advice, training, information, technical solutions, development & test environments etc.
- Foster the harmonization of procurement and service delivery of Assistive Technology products and services among EU member states.
- Require and monitor business plans of funded development projects in Assistive ICT.
- Support the commercial introduction of innovative Assistive ICT products, especially if they come from funded development projects.
- Support the analysis of the chances and potential barriers in bringing new Assistive ICT to the market, also taking into account alternative ways of provision.

5.2.2.7. Practice a policy for “Assistive Technology”

Background

The UN Convention on the Rights of Persons with Disabilities demands the opportunity of a full and effective participation and inclusion in society. This includes the provision of Assistive Technology products according to the current state of art of technology. It is the task of politicians to set the framework and to give direction for the development and provision of Assistive ICT.

Goal

Society, public bodies and political organisations support the provision of Assistive Technology based on ICT where possible and necessary. (from VFass-7)

Supporting and limiting factors

Bridges:	**Barriers**:
• There is some political awareness on the needs of people with disabilities and the political will to take care of these needs.	• The legal requirements and conditions of financial support for the provision of Assistive ICT are complex and differ between the EU countries. (**#81**, **#61**)

Sub-actions and involved stakeholders

Table 15: Sub-actions and stakeholders to practice a policy for "Assistive Technology"

Sub-actions \ Involved stakeholders	end-users and their organisations	secondary users, e.g. caregivers, family	researchers	mainstream ICT developers etc.	Assistive ICT developers etc.	educational and training organisations	advisors, information services	TT agencies, chambers of commerce	standardization bodies	IPR management	public procurement	government authorities; EU Comm.	policy makers, parliaments, legislators	market researchers	business associations	financing organisations	service delivery actors
Foster consistent legislation and/or mandatory regulation concerning Assistive ICT provision to end-users in the EU countries (#40, **#81**)												x	x				
Foster consistent policies for subsidies of Assistive Technology products and services in the EU countries (**#82**)												x	x			x	x
Besides the economic value, regard the social value of Assistive and Accessible ICT in political decisions. (#19)												x	x				
Impose open interfaces for Assistive ICT devices as part of accessibility requirements on publicly available mainstream ICT products and services, where reasonable. (#32)											x	x	x				
Fund research and development projects on Assistive ICT. (Q~21, Q~22)			x		x							x	x				

Kind of potential support by EU Commission

- Foster consistent legislation and/or mandatory regulation concerning Assistive ICT provision to end-users in the EU countries (#40, **#81**)
- Foster consistent policies for subsidies of Assistive Technology products and services in the EU countries (**#82**)
- Besides the economic value, regard the social value of Assistive and Accessible ICT in political decisions. (#19)
- Fund small, practical and goal-oriented projects in Assistive ICT; application and funding procedures should be simple. (**#73**, #76, Q~21, Q~22)
- Develop new mechanisms for international collaborations; develop ways of sharing Assistive ICT knowledge with developing countries. (SDDP2#69, SDDP2#71)

6. Intermediate Results of an In-depth Analysis of Technology Transfer in “Smart Homes”

6.1. Methods

We conducted an extensive literature and web survey of peer-reviewed literature, websites, scientific reports, and commercial websites of projects and published private company projects (power point presentations). Computerized English language only databases were searched (Pubmed, MEDLINE, CINAHL, PsycINFO and Healthstar) using the terms:

- Smart home/house, smart spaces, intelligent, aware house/home, domatics (domos+ informatics), digital home, adaptive house
- Home automation, robotics, assistive technology, geriatric telecare, telemedicine
- Ambulatory home, health smart home
- Integrated environment
- Embedded architecture, responsive architecture.

These keywords were used alone or in combination.

The list we assembled is by no means an exhaustive catalogue of all smart home initiatives worldwide, but rather a representative collection of projects that has been published (in English) related to smart homes.

We have not excluded articles nor applied filters in order to also include new initiatives and efforts not yet even supported by enough evidence and experience. Moreover, initial data collection was performed by architecture graduate students unfamiliar with the publications, the leading companies or projects so as to achieve a sort of “blind” unbiased data collection.

All information was collated into a table and sorted according to the following categories:

Geographical location

- Europe
- USA
- Asia
- Australia

Project characteristics

- Project name
- Reference
- Location (country, state, city)
- Potential users
- Objectives
- Activity (performed within the smart home)

- Funding
- Category
- Image.

A snapshot of the **initial** outline of the table appears below.

Num.	Reference	Location	Project Name	Duration	Potential Users	Goals	Activity	Technology	Technology Source	Funding	Independence	Successes	Image
E1	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2666468/	Japan	Welfare Techno Houses (WTH) medical	From 1995	Elderly and disabled people	The houses provide an opportunity for clients and care-givers to explore issues concerning accessible design, and to participate in trials that enable them to meet their own specific needs	Healthcare, Data Acquisition	Data collection on residents' activity and vital signs by equipping the rooms with IR sensors, the doors with magnetic switches, and the bathroom with fully automated biomedical devices	Technology development of the Agency of Industrial Science and Technology, under the auspices of the Ministry of International Trade and Industry (MITI), and the New Energy and Technology Development Organizations	Ministry of International Trade and Industry, Ministry of Health		Partial success, still problems with data collection and analysis. Further development needs to evaluate long-term data and predict diseases	
E2	Wu et al.,) (2007 http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1228530	Korea	OSGi and Mobile-Agent Technology for smart house	From 1999	All users, elderly	We share our experience in using OSGi to build an open, assistive environment that supports independent living for elders	Entertainment, comfort, remote control	This architecture is a peer-to-peer (P2P) model based on multiple OSGi platforms, in which service-oriented mechanisms are used for system components to interact with one another, and MA technology is applied to augment the interaction mechanisms.	OSGi technolofy				

Subsequently, in order to enable further analysis we performed a secondary filtration and excluded projects which were specific applications or concerned with equipment only.

All information has been coded into categorized parameters and inserted into excel files.

Table description:

Each project was summarized using the following categories (if available):

- ***Project name*** – All projects are organized alphabetically by continent. Project names were a bit confusing as some have changed names; the default was to prefer the original name of the project (sometimes it was named after the location, or several names were used by different authors).
- ***Country*** (presented by international country abbreviation)
- ***Potential Users*** – Classified as one or more of the following six categories:

  A – **A**ll kind of users – for all people of all ages

  E – **E**lderly people

  C – Chronic disease – people who suffer from all kinds of chronic diseases

  D – People with **D**isabilities - mostly individuals with physical disabilities

  F – **F**amilies of elderly people

  N – **N**eurological – people who suffer from diverse brain injuries and/or have memory trouble, e.g., dementia, Alzheimer's, etc.
- ***Objectives*** – What are the project's goals (abridged, in free text)?

- ***Activities*** – The activities were divided into four categories:
  S – **S**tandard of Living and Comfort
  M – **M**edical and Physiological Monitoring
  B – **B**ehavioral Monitoring
  L – **L**ocation Monitoring
- ***Funding*** – Sources were classified as one of four types:
  EU – European Union
  N – National funds
  P – Private companies
  U – Universities, academic funds
- ***Characteristic / category of the publication***
  E – Experimental laboratory for technological and clinical evaluation, usually located at a university.
  R – Real project – commercial entity
  I – Initiative, consortium, project, research initiative
  A – Application for the smart home (significant)
  L– Living laboratory, residency where people live for various time periods
  T – Testing laboratory for testing and demonstration of equipment, set-up and procedures, typically in partnership with industry and serving educational aims
- ***Image*** – A representative small image (if available) appears in the table.

All information was exported into an Excel file for analysis. The file presenting only the categorized information: potential users, activity, funding and categories. (Table 16 – Table 20)

6.2. Data analysis

1. Data are analyzed as a whole and according to continents (Europe, USA, Asia and Australia).

Based on the lack of well-supported scientific evidence and exclusion criteria for the publication, the analysis could not use quantitative statistical methods. Only descriptive analysis and correlations among the different variables (e.g., potential users and funding, activities and funding, etc.) and typical clusters are performed (*the analysis will be presented at the final report*).

All information is presented by frequency (percentages as size of groups is not equal).

2. Evaluation of smart homes according to results of the first two SDDP workshops:

SDDP1 on Cyprus:

What mechanisms would ensure successful technology transfer in accessible and assistive ICT products and services?

The following four mechanisms were probably the most influential and stakeholders should give these a higher priority:

#15: Provision of procedures, easy to use tools and environments for accessibility testing

#44: Provide incentives to bring academia, industry and users together

#23: Support user involvement in all phases of product life cycle

#20: Offer incentives to suppliers who offer effective accessible products and services.

SDDP2 at San Sebastian

What type of research is missing that could facilitate development of inclusive HCI?

The four most influential elements that emerged from the San Sebastian meeting *will be presented at the final report*.

SDDP2#69: New mechanisms for international collaboration

SDDP2#21: Consider not only the interface as it appears but the entire interaction dialogue

SDDP2#29: Research methodologies that efficiently collect data about users including existing HCI (quantitative tools like needs, skills interests, limitations)

SDDP2#32: support research that looks how to reduce the complexity of users' interaction whilst retaining functionality

SDDP2#41: Use reasoning (AI) techniques for personalization

Problems and limitations of the study

- Difficulties in defining the categories appearing in the table.
- Project potential users are not always defined.
- Funding is vague, and most of the information was taken from the authors' acknowledgement and the affiliation.
- Difficulties in naming of the projects: different names at various stages, sometimes named after the location, sometimes after the university or the writer.
- The projects are at different phases of their performance, and different level of maturity - some preliminary reports (in conferences) and some concluding data.
- A small number of projects from Australia and Dubai that does not enable comparison, and therefore, were emitted from the study.

- Projects with different levels of details; some information is missing and some was guessed at.
- Publication distributed over several years.
- Difficulties in definition of categories; Living lab, experimental cottages, training apartment, testing flat and more are the definitions used by authors.
- **The most problematic and significant limitation is the no criteria for or indication of the success or failure of the project.**

Table 16: Smart Houses Experimental Projects – Europe

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	O	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	AP	L	T
2 (E2)	Aware Home TNO/DUT	NL		X	X					X			X		X	X	X					
	AZTEC	UK																				
58	BESTA	NO		X		X	X	X	X		X		X			X		X			X	
44	CarerNet	UK	X		X			X		X	X				X					X		
14 (E14)	CENELEC Smart House Roadmap	EU	X						X	X				X		X			X			
46	CHS	GR	X	X	X				X	X			X	X	X					X		
59	comHOME	SE				X		X			X		X		X	X	X				X	
16 (E16)	Digital life center	NL		X			X				X		X		X	X					X	X
15 (E15)	Domus: Effective Smart Home Systems	IE	X	X		X			X	X					X					X		
24 (B8)	EDC	UK	X	X			X		X	X			X			X						X
60	Enable Project	UK IE FL LT NO		X				X	X		X		X	X	X				X		X	
47	EPIC	ES		X	X	X			X	X				X						X	X	
33	Gloucester Smart House	UK		X				X			X	X	X	X	X	X	X	X			X	
3 (E3)	HIS AILISA	FR		X	X					X	X	X	X		X		X				X	
8 (E8)	HomeCare	CZ	X	X					X	X	X	X			X		X					
50	SITHS	SE			X		X			X			X		X	X				X	X	
42	Training apartment	SE						X		X	X				X	X					X	X
45	MIDAS	UK		X		X			X	X	X	X	X		X					X		
30 (B2)	Model House	NL	X	X		X	X		X	X				X	X	X		X			X	X
11 (E11)	Persona	EU DK IT ES		X						X				X					X			
	Philip's Home & Care lab	NL	X	X					X	X	X			X	X	X					X	
27	PROSAFE	FR		X		X		X			X	X	X		X	X	X			X	X	

			Potential Users						Activity				Funding				Categories					
6 (E6)	SerCHo Service Centric Home	DE	X						X				X		X	X			X			
25	SmartBo	SE	X	X		X		X	X	X	X		X		X	X					X	X
63	Smartest House of the Netherlands	NL	X	X					X				X			X						X
5 (E5)	SmartLab	SE		X		X			X	X			X									X
12 (E12)	Soprano	EU		X					X	X				X	X	X			X			X
54	TERVA	FI		X						X			X		X	X				X		
51	TIISSAD	FR		X	X	X				X	X				X	X			X	X		
52	TIMC-IMAG labratory	FR		X		X				X	X		X		X	X	X			X	X	
20 (B4)	VALLGOSSEN	SE	X	X					X				X		X	X		X			X	
10 (E10)	Vital	EU		X					X					X	X	X			X			
4 (E4)	VITAL-HOME	GR		X	X					X	X	X		X	X				X	X		
19 (B3)	Zwijndrecht	BE		X					X				X					X				

Table 17: Smart Houses Experimental Projects – USA

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	E	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	A	L	T
20	ACHE	US	X	X		X					X				X							
3 (E19)	Adaptive house	US	X						X		X				X	X	X				X	
18 (B9)	Aware home	US	X	X	X		X	X		X	X		X		X	X	X	X	X		X	
16 (B13)	Casensa	US		X			X	X			X	X	X		X	X	X	X		X		
17 (B14)	CISCO Internet Home	US	X						X							X						X
8 (E24)	Domus smart home Canada	CA		X					X		X	X			X		X					
10 (E26)	Duke Smarthome program	US	X						X						X	X					X	
14 (B11)	Gator Tech Smart House	US	X	X		X			X	X	X		X		X		X					
21 (E20)	HAT - Home Asthma Telemonitoring	US			X					X	X		X		X							
39	iCue system	US		X				X		X	X		X		X	X	X			X		
37	ILSA	US		X			X			X	X		X		X	X		X		X		
24	MavHome	US	X						X	X	X		X		X	X	X			X		
7 (E23)	McKeesport Research Cottages	US	X	X		X	X	X	X	X	X		X		X	X		X			X	
1 (E17)	Microsoft Home	US	X						X						X	X	X					X
25	Oatfield Estates. Elite Care	US		X			X	X	X	X	X	X	X		X	X		X			X	
9 (E25)	PlaceLab House_n	US	X						X		X	X	X		X	X					X	

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	E	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	A	L	T
5 (E21)	Smart Medical Home	US	X	X	X				X	X					X	X					X	
57	TigerPlace	US		X						X	X	X	X		X	X					X	
2 (E18)	UMASS Intelligent Home	US	X						X				X		X		X					
6 (E22)	ZUMA:	US	X						X						X	X				X		

Table 18: Smart Houses Experimental Projects – Asia

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	E	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	A	L	T
8 (E35)	Aware Group Home	JP		X			X	X			X	X	X		X	X	X				X	
13 (B18)	DAMAC's residential towers	Dubai	X						X							X						X
6 (E33)	Intelligent IPMPS in Ubi-Home	KR	X						X			X	X		X					X		
7 (E34)	Intelligent Sweet Home. Kaist	KR		X		X			X	X	X		X		X		X			X		
15	WTH Mizusawa	JP			X					X	X	X	X		X	X					X	
14	Osaka smart house	JP	X						X		X	X	X		X					X	X	
3 (E30)	OSGi Mobile-Agent Technology	TW		X			X		X				X		X					X		
2 (E29)	Robotic Room	JP		X	X	X				X	X		X		X		X					
11 (B16)	Smart Houses	KR	X						X				X			X		X				
16	Smart House Tokushima	JP		X				X		X	X		X			X						
5 (E32)	STARhome	SG	X						X	X	X				X	X						X
10 (B15)	Toyota Dream House PAPI	JP	X						X							X						X
31	Ubiquitous Home	JP	X	X					X		X	X	X		X	X					X	
4 (E31)	ubiTV application	KR	X				X			X		X				X				X		
1 (E28)	Welfare Techno House Takoma (WTH)	JP	X	X		X			X	X	X		X		X	X	X				X	X

Table 19: Smart Houses Experimental Projects – Australia

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	E	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	A	L	T
1	Hospital Without Walls	AU		X	X					X	X				X	X	X			X		
2	New South Wales	AU	X	X	X					X	X	X			X	X				X	X	
48	MISC Celler et al.	AU	X	X	X					X	X				X	X			X	X		

Table 20: Smart Houses Experimental Projects – Global

Num.	Project Name	Country	Potential Users						Activity				Funding				Categories					
			A	E	C	D	F	N	S	M	B	L	N	EU	U	P	E	R	I	A	L	T
2 (B20)	Global village initiative		X	X		X			X	X						X			X			
1 (B19)	LG Home Smart Solution		X						X							X		X				

Table 21: Problems and suggestions arising from the literature review

Problems	Explanation	Suggestions
Lack of evidence	Lack of empirical evidence to support or refute the use of smart home technologies (Cochrane study, Martin et al., 2009)	- Controlled studies and field studies - Research (quality, controlled) - Defining outcome measures for failure and success (not only economical) - Long-term follow-up of SH projects - Large randomized studies
Privacy and confidentially	Confidentiality Big brother Access to data (who will see?) Transfer to third party Invasion into private life and discrete space	- Sensors instead of cameras (floor and pressure sensors, IDRF) - Use infrastructure sensing methods - No cameras and videos in bathroom - Silhouette instead of clear picture - Replace visual monitoring by auditory monitoring - Develop algorithms for movements etc. - Control who will see the data and safety procedures on encryption technology - Develop data protection mechanisms - Store non-identified data
Standardization	Interoperability of devices is complicated by the disparity at several levels: different wireless technologies, device communication protocols, and presentation standards. Agreement on a common set of standards is doubtful	- Methods must exist that allows the connection of any set of devices to any other set of devices
Image, branding	-Represent old age, fragility, disability, end of life, sickness	- Branding as future living for everyone - All-family housing including children and grandparents/Home for two generations - Add and emphasis entertainment and safety - Adapt to local culture - Combine with state-of-the-art electronic and leading international companies - Design home that does not look different from any normal dwelling - Make sensing invisible to visitors - Marketing SH among young (middle aged) people
Cost	-Smart homes have the image of being costly and luxurious	- Use and develop available Infrastructure – not de novo building - Support from insurance companies

Problems	Explanation	Suggestions
	-Need to install equipment and change home -Cost includes product cost and process (training, administrative costs) over time -Perception of limited market	- Loans - Funding from national and municipality sources(Veterans administration) - Not one of a kind housing – but complex of SH, community, neighborhood, regional planning for smart homes/smart city - Connection to veterans groups - Increase market
Users' needs	Most past SH focus on technical and physical aspects. Most SH focus on elderly and disabled needs Cultural diversity No clear definition of "user"	- Adapt to **all** stakeholders - Adapt to **changeable** needs over time and situations - Assessment not only by technology criteria - Ask **all** users, including insurance companies - Have the elderly and caregivers in living laboratories - Involve **all** users in **all** stages (from the beginning development, design, implantation, testing. - Adapt for specific culture (e.g., Japanese style living laboratory) - Supply also services (movie, TV) and information (weather, stocks) - Develop a personalized environment – broad range of occupants - **Ask not what technology will be in future SH but what do we need?** User-centered research; people-centric approach
Overall-holistic approach	Tend to focus on the technical performance of sensors in laboratory settings; Single device approach and/or single patient approach regarding only installation Most current SH are focal, one of a kind installation Conflict between users	- Holistic approach of home and not for specific device - Compatibility between components, infrastructure, maintenance, tutoring - Community planning, regional planning - Universal city – intelligent living environment hospitable to everyone, including elderly, disabled and children - Smart city - Integration of components - Develop a "cluster community": several projects in close proximity - Need for training and education - Personalization
Effect on life style	Changes in the position of home master Difference in dominance Reducing need for self-decision few studies on social effects of SH	- Involve Psychologist and sociologist in teams developing smart homes - Increase psychological studies in smart home issues
Ethical issues	Is it ethical to reduce a person's capabilities? Who will decide for him what is good? Removing choice Transfer of personal information to third party	- Research on ethical aspects of SH
Psychological barriers	"Big Brother" Fear for reduction of	- Transparent sensors; people are not aware of their existence

Problems	Explanation	Suggestions
	social interaction Dependency on automation SH will substitute personal care & contact	- Education
Does not represent "real life'	Checked in a lab – sterile environment experiments separate and check singular parameters Limited duration of subjects under observation Different users share devices(conflict) Not natural behavior	- Living laboratories – real houses with long-term follow-up - House with cultural style rooms (including for different ages) - Have the elderly and caregivers live in living laboratories - A portable toolkit of sensors that for monitoring at-home behaviour for some period (before and after laboratory) (MIT development) - -computers create separate accounts for each user
Limited market		- Expand the usage to other fields such as hospitals, business offices, public places etc. - Combine with international IT companies that develop and sell IT products to increase market and awareness (e.g. Toyota, Philips) - Combine with security companies - Open demonstration halls to show capabilities

6.3. Assessment of smart homes according to the most influential factors as identified at the SDDP meetings

Smart homes were selected as a case study, and in addition to their evaluation through a literature review, we decided to assess them according to the most influential factors as identified at the SDDP meeting in **Cyprus**, whose topic was: **What mechanisms would ensure successful technology transfer in accessible and assistive ICT products and services?**

The following section is an initial attempt to correlate the four influential points of the Cyprus meeting with smart homes. The Excel™ file (Table 16 – Table 20) helped us identify the relevant elements for each influential factor and were backed with indirect information from general reviews.

The most influential factors identified at the Cyprus SDDP meeting:

#15: Provision of procedures, easy to use tools and environments for accessibility testing.

“Provision of procedures, easy-to-use tools and environments for accessibility testing” as means to ensure successful technology transfer” of smart homes can be followed in Table 16

– Table 20 under the "*category"* columns. The options of **E**xperimental laboratories, **L**iving laboratory and **T**esting laboratory and a demonstration of equipment halls provide a well-structured and equipped environment for accessibility testing.

- **Experimental laboratories** are usually adjunct to universities in which students and companies can easily develop and test ideas, concepts, and equipment and explore environments for accessibility. The students can carry out their projects as part of their studies.

  Commercial companies usually contributing to experimental laboratories through financial support, grants or providing hardware and software to be tested.

  The most common experimental laboratory model is a multidisciplinary laboratory in which different academic disciplines are represented. They can be staffed by personnel from the Faculties of Computers Science, Architecture, Electrical Engineering, Mechanical Engineering, Medicine, Industrial Design, Psychology and more, in various combinations including also the participation of research centres.

  Examples of experimental laboratories include:

  # 3 US The adaptive house, University of Colorado; # 18 US Aware Home, Georgia Tech; # 10 US Duke Smarthome; # 9 US PlaceLab and house_n, MIT, Boston; # 57 US Tigerplace part of the project "Aging in Place," University of Missouri;

  # 2 EU Aware home TNO/DUT, Delft university, Netherlands; # Philips Home & Carelab, Netherlands; # 59 EU comHOME, Sweden; # 8 EU Homecare, Ostava University, Czech Republic; # 33 EU Gloucester's smart house, bath institute; # 3 EU HIS and AILISA Grenoble, France;

  # 8 AS Aware group home; #7 AS, Intelligent Sweet home (KAIST) Korea; # 2 AS Robotic room Tokyo, Japan.

- **Living laboratories** are moving out of the laboratory setting into people's homes. They are real dwellings that are fully built and equipped, in which people stay for extended time periods and live under observation. Living laboratories are mostly affiliated or work with academia and research centres, thus facilitating study of subjects, care givers and families around clock in relatively natural environment with availability. Equipment (e.g., sensors, cameras, actuators, intelligent agents etc.) are installed in the residents' housing and (almost) natural data are collected over prolonged time periods (even years). Such living laboratories are either built de novo by national or public authorities or use existing dwellings that are equipped accordingly: private single homes/apartments or a complex of apartments (e.g., senior citizen housing).

  Examples of living laboratories:

  # 7 US McKeesport Research Cottages, Carnegie Mellon and University of Pittsburgh (research cottages); # 5 US Smart Medical Home, Rochester; #57 US Tigerplace, Missouri, working in collaboration with a long-term care corporation, Americare

Corporation of Sikeston; #18 US Aware Home, Georgia Tech; # 25 Oatfield Elite Care, Oregon.

59 EU comHOME, Sweden; # 20 EU Vallgossen, Sweden; 126 flats residential housing units, equipped with ICT technology; # 42 EU Training apartment for person with brain damage, Sweden; # 60 EU ENABLE ; # 33 EU Gloucester 's smart home; # 3 EU HIS and AILISA, Grenoble, France; # 30 EU Model House, Netherlands.

14 AS OSAKA smart house, Japan; # 15 AS WTH (Welfare Techno House), Mizusawa, Japan; # 8 AS Aware group home 6 people with dementia living with caregivers, Japan.

- **Testing and demonstration centres** are a collaborative initiative in which innovative technology is demonstrated to audiences and checked for integration with existing technology. People can visit the demonstration sites on daily visits, for weekends and for longer periods.

The demonstration centres are equipped with currently available innovative technology and this is an opportunity to study the trade-offs of the technology.

Some demonstration smart houses are located in several major cities or moved from site to site e.g., # 30 EU Model house, Eindhoven, Netherlands ; # 21 EU Edinvar (Assisted Interactive Dwelling House) , UK; # 24 EU EDC (Equipment Demonstration Center) ,UK; # 16 EU Digital life center, Netherlands; # 25 EU Smart Bo, Sweden, #5 EU SmartLab, Sweden, # 12 EU SOPRANO integrated project system, funded by the EU commission, is to be installed in 100 homes in each country. This is a large scale demonstration, in which 100 users will visit each laboratory to use and evaluate the system.

17 US CISCO House; # 1 US Microsoft Future Home

5 AS STARhome, Singapore is a fully furnished and functional model home (in the form of a show-flat) with extensive infrastructure to showcase innovative and integrated smart home technologies. It serves as a real-life test bed for deploying, testing and refining innovations, a platform for developing and testing applications and integration of emerging technologies for the home which, hopefully, may lead to new commercial products for the world market. Companies from diverse industries are involved; # 1 Japan Welfare Techno House (WTH),Takoma comprises 16 demonstration and research houses located across Japan, providing an opportunity for clients and care-givers to explore issues concerning accessible design, and to participate in trials to check if the technology meets their own specific needs. The houses are used for testing and exhibition of new products and design concepts. Elderly and disabled people may stay in the houses for several days in order to try out the facilities. In addition, manufacturers are able to test their equipment, although no accreditation is given based on this use; # 10 AS Toyota Dream House (PAPI), Japan.

An initial non-quantitative analysis (relative rate) demonstrates dissimilar proportions between experimental and living laboratories at the different continents; there are more living

laboratories compared to experimental laboratories in the EU compared to the US and Asia (47 vs. 20% EU; 47% vs. 47% US; 33% vs. 27% Asia, respectively).

#44: Provide incentives to bring academia, industry and users together

The most relevant process for "providing incentives to bring academia, industry and users together" in smart homes can be identified under the column of *funding* in (Table 16 – Table 20):

- Many grants, funding agencies and consortia insist on having partners both from academia and industry (private sector) as pre-requirements for receiving the financial support (especially, national or international granting agencies such as the EU commission). *In the* Table 16 – Table 20 *we can see a significant number of projects being funded by three agencies: national, academia and private (industry) sectors (N+A+P): 32% in the EU; 47% in the US and 26% in Asia.*

  Some examples of significant national initiatives bringing academia, industry and users together:

  # 12 EU SOPRANO integrated project funded by the EU commission – consortium of enterprises, public bodies, and universities (over 20 partners from seven European countries);

  # 11 EU PERSONA Integrated project supported by the EU and several European countries, members include academia and companies. The outcome of the evaluation and validation in test-beds and trails is being conducted in three sites: Spain, Italy and Denmark.

  # 5 AS Singapore STARhome is supported by the Singapore Science and Engineering Research Council. It has extensive infrastructure to showcase innovative and integrated smart home technologies from various research institutes, universities and industry partners, centering on four major lifestyle ideals – Healthcare and Comfort, Safety and Security, Automation and Control, and Entertainment and Information. STARhome is an incubator of innovative technologies, where researchers can actually live and work in an environment that would facilitate feasibility, reliability and usability studies. It is also a place where realistic applications and features will demonstrate the benefits of the new technologies; where companies will have great opportunities to translate these cutting-edge technologies into commercially viable products. STARhome is aimed to excite local industry and users about the possibilities of new smart technologies for the home.; # 1 AS Japan Welfare Techno House (WTH) Takoma, built by the Japanese Agency of Industrial Science and Technology, under the auspices of the Japanese Ministry of International Trade and Industry (MITI), and the New Energy and Technology Development Organizations (NEDO) in collaboration to support the construction of 16 demonstration and research houses across Japan.

An additional incentive for involvement of industry in research laboratories is to provide students with an opportunity for practical hands-on engineering outside the classroom, in a

living and learning community. In addition, the partnering with industry strengthens the community and helps homeowners make their own ideas for smart homes a reality.

Living and experimental laboratories operating in collaboration with industry are a stimulating element for opening designated educational programs in the field of smart housing, thus increasing the research capabilities and academia's awareness of this domain (e.g., # 10 US Duke Smarthome program; # 18 US Aware home Georgia Tech).

- A specific domain for collaboration between academia, industry and users that is rapidly developing is within the **healthcare domain**. The greying of the population, the increase of chronic diseases, growth of healthcare expenses and the distribution of e-health services are creating a great incentive and an inviting environment for collaboration. Healthcare and wellness are among the important issues for people.

  Some examples for academia, industry and users collaborations in the healthcare area:

  # 57 US Tigerplace – A collaboration between academic and private business: the University of Missouri (MU) and a major long-term care corporation, Americare Corporation of Sikeston, Missouri. This endeavour involves many different academic disciplines including: nursing, electrical and computer engineering, social work, physio-therapy, occupational therapy, environmental design, landscape architecture, health informatics, and business; #5 US Smart Medical Home, Rochester.

  # 59 EU comHome with collaboration with industry, academia and organizations working with the disabled Swedish Handicap institute; # 33 EU Gloucester's smart home project funded by UK government; EU and professional organisations and nonprofit organizations focusing on Dementia.

68% of the projects in the EU are involved with medical issues, 53% in the US and 47% in Asia (Table 1). Further analysis will characterize their profile, funding sources, collaborations, users, healthcare sector, research capabilities etc.

#23: Support user involvement in all phases of product life cycle

"Supporting user involvement in all phases of the product life cycle" is achieved mostly through involvement of users, their family members and visitors in testing and demonstration homes and in living laboratories.

A model for participatory formative evaluation has been applied in # 57 US, Tigerplace included interviews, observations, focus groups and Delphi studies. For the Delphi study, smart home designers and researchers as well as community-dwelling older adults were asked to identify smart home features that would support independence and shared decision making for older adults.

16 US Casensa, 22 elderly with and without early dementia and their caregivers; # 7 US Carnegie Mellon and University of Pittsburgh (research cottages) ; # 9 US MIT house_n and PlaceLab – use multiple ethnographic and lab-based methodologies (survey, interview, observations, portable kits, demo labs and tests in a lab) to expose users to a wide range of

applications and technologies and get their input.; # 57 US Tigerplace: moving into elderly people's residences (a senior living facility) involving their families, caregivers, nurses etc. and students. The formative evaluation approach involves the end-users in all phases of the system design and implementation and aims to integrate feedback acquired via quantitative and qualitative methods into the design in order to increase usability. The evaluation model includes observations, focus groups and interviews with representative users.

21 EU Edinvar (Assisted Interactive Dwelling house), UK; # 30 Eindhoven Model house, placed in several major cities – collecting the comments of thousands of visitors and gathering interviews over the years; # 25 EU SmartBo demonstration apartment operated by Handicap Swedish institute (nonprofit, professional organization); # 12 SOPRANO integrated project funded by the EU commission – consortium of enterprises, public bodies, and universities (over 20 partners from seven European countries) concerned with understanding of the care needs of older people; # 20 EU Vallgossen, Sweden: Structured interviews with residents were used to evaluate the benefit of ICT technology installed (without additional fees) in 126 residential flats.

8 AS Aware group Japan: The caregivers (of 6 people with dementia) are involved and the development of the system is based on their comments; # 7 AS Intelligent sweet home KR based on a questionnaire and preferences of disabled people regarding smart home equipment; # 31 AS Japan “Ubiquitous Home”: A husband and wife spent 16 days in the “real- life test bed” that was designed according to traditional Japanese-style rooms in which specific Japanese services were checked.

#20: Offer incentives to suppliers who offer effective accessible products and services

The most relevant mechanisms for offering incentives to suppliers who provide effective, accessible products and services can be seen (mostly indirectly) under the columns of "*category*" and" *funding*"; however, not much information is available in the printed literature.

Examples:

24 UK EDC - area for demonstration SmartHome area supported by Westminster city council; # 19 EU Zwijndrecht Belgium Flemish government stared a program to build 5000 service flats within 10 years

1 AS Aware Group home, Japanese Agency of Industrial Science and Technology, under the auspices of the Ministry of International Trade and Industry (MITI), and the New Energy and Technology Development Organizations (NEDO) collaborated to support the construction of 16 demonstration and research houses across Japan, known as Welfare Techno Houses (WTH). The houses provide an opportunity for clients and caregivers to explore issues concerning accessible design, and to participate in trials that enable them to meet their own specific needs. Manufacturers are able to test their equipment, although no accreditation is given based on this use.

7. Summary & Conclusions

7.1. Summary

Following an in-depth analysis of the market, a number of issues have become apparent in successful technology transfer, including the complexity of the market and lack of standardised regulation. Moreover, these issues also effect the development of new products, in the field of Accessible and Assistive ICT, with the absence of a clearly defined market, and on the coexistence – at EU level – of a large number of different service- and business models, even between different regions of the same Country. These issues make plans for new products and services quite complicated, if not impossible, and often hinders investments.

”The absence of a recognised set of standards for horizontal interoperability of assistive products and services makes it even more difficult” (Odetti).

In simple terms this report reviewed the technology transfer process involving a range of formal and informal cooperation’s between laboratories and the public and private sectors. The purpose of technology transfer is to strengthen the economy by accelerating the application of laboratory technology and resources to private and public needs and opportunities. Product improvement, service efficiencies, improved manufacturing processes, joint development to address government and private sector needs, and the development of major new products for the international marketplace are the results of successful technology transfer efforts.

Diffusion of information about new technology is predominantly a process of communication. Anything that impedes communication within the organisation, as well as within the environment it interacts in, will jeopardise the successful implementation of the technology within the organisation.

A primary concern is the fiscal justification in terms of returns on the investment and the irreversibility of the investment, where adoption requires investments in unsalvageable products. The payback period and the significance of the payback are intrinsic to the justification.

The decision to adopt technology is heavily influenced by environmental factors. These are the events occurring in the industry, market, country and the world in general, within which the organisation interacts.

Ultimate end-users must do something different from what they have done in the past. They must change their patterns. A consequence of this is that it cannot be expected that the recipients will respond to new technology quickly. They must not only assimilate facts relevant to the technology, but also change patterns that would lead them to use the technology. It is considered human nature to resist ideas, especially those originating from outside of the organisation, and this can lead to myopia or tunnel vision. A clear implication is

that technology transfer requires time, patience and opportunities to experiment in new technology.

At industry level, the decision to adopt technology is also heavily influenced by organisational factors. Organisations are more likely to be willing and able to adopt technologies that offer clear advantages, do not drastically interfere with existing practices, and are easier to understand. Adopters look unfavourably on innovations that are difficult to evaluate or which benefits are difficult to see or describe.

The decision to adopt technology is influenced by the technology itself and if the technology fails to live up to the expectations of the eventual users then its implementation will not be successful.

A further finding was that commercialisation has one of the most effective methods of technology transfer. Many organisations will not invest in many TT projects if they can not clearly see the commercial benefits at the outset. This has hindered the link between research centres and industry. Equally, research centres have a poor reputation for delivering close to market prototypes with industry saying that often much further investment in research and testing is required.

Complexity is a barrier when looking for regulatory clearance due to the broad range of country standards and regulations. This is seen as the single biggest barrier. The plan for successful marketing of the product, created by assessing perceived need for the product, size of potential market, expected sales, advantages over competing products, and the cost of promoting the product is a risk that many large organisation are not willing to take for minority group developments. In reality return on investment comes first and accessibility second in most cases.

Going forward, there is a strong need for better communication and links to be developed and maintained between industry, user and research organisations. This requires the effective identification and specification of research needs, and knowledge of relevant research that is being conducted. For this to happen, industry needs to be involved at an early stage of research, so as to be able to participate even in the research definition stage. At the same time, public sector research organisations need to be prepared to support industry in the commercialisation process. Efforts to erase preconceptions that build barriers to successful technology transfer should also be taken.

7.2. Towards a best practice methodology for technology transfer in Accessible & Assistive ICT

Following a survey of mainstream ICT companies (see evaluation summary, 8.3.7) it is evident that best practice in technology transfer is complex. It involves the whole innovation process from the initial idea to a successful product or service on the market. It involves legal processes and ownership. Transfer of knowledge in any sector evokes many issues. The concept of technology transfer is to get good ideas, inventions, and technologies developed into manufacturing as quickly as possible. However definitions of technology transfer abound and the practice continues to progress, involving different types of organisations within the private and public sector, including large and small companies, universities etc.

Recognition of the global nature of technology transfer, policy makers at both an international and European level are moving to ensure that standards are adhered to, to ensure an inclusive society involving collaboration at all levels. The importance of an inclusivity is enormous. Some 15% of Europe's population has a disability and we are growing old quickly. Increasingly many aspects of daily life are dependent on technology-based products and services. It is generally accepted that costs are typically a lot lower at the design stage in comparison to the costs of retrofitting accessibility for products and services that already exist, and it is to this end that collaboration is important with all stakeholders.

In today's environment, best practices change rapidly and the capturing and reusing of best practice is an important part of the next generation product development. No one methodology works for all but at the outset, and to chose the right methodology for each project, project objectives and key performance indicators must be identified. Only then can a good/best methodology be chosen. Essentially, a methodology must be able to deliver the project objectives.

Within the CARDIAC survey of companies, collaborative projects, both at national and European level are cited as the one of the tools found successful in technology transfer, bringing together the knowledge of the universities and research centres to companies for adoption and possible market exploitation. Further collaboration is ensured with the subcontracting or employment of researchers from universities or research centres and participation in international workshops on the topics of interest.

Achieving the goals of economic success for manufacturers depends on identifying the needs of customers and to design and make the product quickly and at a reasonable cost. It is not only a design, manufacturing or marketing issue, it is essentially a product development problem involving all of these. Some companies may have superior development design strengths, however, failure to transfer this knowledge (people leave/lack of communication etc) can lead to wasted activity, poor products or simply reinventing the wheel.

Supporting factors for best practice in technology transfer include:

- greater communication and interaction between key parts of government
- intra- and inter-governmental coordination, cooperation and assistance;
- protection of intellectual property rights and legal contracts;
- political support for programmes and institutions that foster technology transfer;
- seed investment programmes to stimulate private sector investment;
- capacity enhancement for major stakeholders;
- delineation of the roles of the private and public sectors in both developed and developing countries;
- economic incentives targeting industries that have the potential to make critical and major contributions to technology transfer; and
- ensuring that technology transfer initiatives are compatible with national sustainable development agendas;
- increase communication among technology transfer bodies across various multi-lateral environmental agreements with a view to leveraging limited financial and human resources on issues of common interest, integrating and strengthening regional and country level activities through information sharing and joint activities and providing a platform for multilateral approaches and consistency in technology transfer.

7.3. Next steps in the road-mapping process

So far the first steps in the development of a road-map of supportive actions in technology transfer in Accessible and Assistive ICT were relative general and have led to results that could be applied in principle to all technologies in the domain.

The next step will be the **validation** of the adequacy and feasibility of the actions of the first draft roadmap (as described in chapter 5) by matching the actions/ activities against the activities of the draft research roadmaps generated in WP3 “Inclusive Human-Machine Interaction” and in WP4 “Network-based Applications”. – In other words: ‘**Technology transfer’ meets ‘technology’**.

This match of technology transfer actions with concrete and specific Accessible and Assistive ICT will be complemented in a following step by a state-of-the-art study about solutions that support developers of mainstream ICT-based products and services to realise accessibility (Task 1.2) and the identification and mapping of **existing technology transfer supports** available throughout the EU (Task 1.5).

The final step will be the building of a **roadmap of supportive actions in technology transfer**, including short/ medium/ long term objectives and ways of coordination and cooperation of stakeholders.

8. Annexes

8.1. Technology transfer “Means and Influence Graph” – Results from the first SDDP co-laboratory

8.1.1. Identification and clustering of mechanisms to support technology transfer

The participants of the first CARDIAC SDDP co-laboratory in the year 2010, i.e. project members and invited external experts, shared 88 ideas on mechanisms in response to the triggering question “What mechanisms would ensure successful technology transfer in Accessible and Assistive ICT products and services?”.

(The methodology and results of the first SDDP co-laboratory, including discussions on the project’s Wiki and in virtual meetings are described in detail in Deliverable D2.1 “Technology Transfer Influence Tree for WP1”.)

Those mechanisms were categorized in 15 clusters:

- Cluster 1: Technology transfer process
- Cluster 2: Consumers accessibility
- Cluster 3: Future improvement
- Cluster 4: Market supports
- Cluster 5: Awareness
- Cluster 6: User needs
- Cluster 7: Technical design requirements
- Cluster 8: Procedures
- Cluster 9: General accessibility
- Cluster 10: Target groups
- Cluster 11: Policy
- Cluster 12: Interconnectivity
- Cluster 13: Positive monetary aspects
- Cluster 14: Simplification of projects
- Cluster 15: Marketing

8.1.2. Description of mechanisms to support technology transfer

The 34 most important or influential mechanisms were identified, and it was distinguished whether a mechanism would be relevant for technology transfer in the area of Assistive (AT) ICT systems or in the area of Accessible (ACC) mainstream ICT systems.

The following tables show the 15 clusters with descriptions of the 88 mechanisms and the relevance of the 34 most important mechanisms with respect to technology transfer in AT ICT or ACC ICT. Each description consists of

- an ID number for internal representation purposes,
- a title which represents the main idea of the mechanism,
- an explanation which points out different aspects of the mechanism.

Table 22: Mechanisms of Cluster 1: Technology transfer process

Mechanism: ID – title – explanation	**ACC relev.**	**AT relev.**
#1: **A mechanism to understand where ideas fall over or go wrong in the supply chain** A mechanism to understand where ideas fall over or go wrong in the supply chain interested in understanding why great ideas fail. I drew up a mini supply chain: is it user driven in user needs? Is there a common set or rules to apply in the supply in the chain? Procurement= User need/requirement, market pull/push it, supply chain (LE takes idea to market?), manufacture, development/prototyping, R&D. (Identical to Idea #79.)	yes	yes
#11: **Realizing proof of concept is not a product or service** At the start of the technology transfer process often only proof of concept is available. For some people this might be the end point but it is actually a beginning. There must be a clear approach on how to move forward from the initial idea to a product/service. ‘Don’t stop when the baby is born’.		
#18: **Identify and effectively communicate the market potential of assistive ICT products and services** Very often, mainstream industry does not realize the real market potential and the wide user base of Accessible and Assistive ICT products and services. If this is identified and communicated to the industry, it will increase their active involvement in the process of turning a concept/research prototype to a successful product/service.		
#51: **Learn how to sell the technology** If you are able to see the benefit, how to use it will be easier o reach the end users. A different mindset is needed. Developing something and selling something are two different types of expertise. Articulating the (added) value of what is available can positively influence the technology transfer.		
#56: **Better understanding of the process involving research, development and technology transfer in ICT** To pay more attention to transition phases between them research development and technology transfer which are in many cases critical issues, sometimes not observed by the same perspective by all people involved. A better description of the process is needed in order to identify critical issues.	yes	yes

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#68: **Insight into gaps in the role and responsibility among stakeholders** Not one single stakeholder can do it all cooperation is necessary. More complex than a blue-ray player and a disk that can be played on that. This area is far more complex, dynamic group of stakeholders with different interests.		
#77: **Promote models of rapid, iterative development for ICT** Be prepared! The market does not wait! The time taken between concept evolution and a market ready product costs companies money. Most companies I have worked for have gained a market share by "pushing" technologies, and having the resources to facilitate rapid, iterative design during the life cycle of the product. My personal belief is that if this can work for manufacturing technology where significant market share is at stake, then it will work for Accessible ICT development as well.		
#88: **Instigate a mechanism to support the transfer of technology from other areas of research** Such areas could be e.g. aerospace industry or military industry.	yes	yes

Table 23: Mechanisms of Cluster 2: Consumers accessibility

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#3: **Accessibility filter in company product R&D process** An accessibility filter based on international guidelines and standards will assist designers and product specialists to firstly understand accessibility and secondly guide them to develop more accessible products and services.	yes	no
#9: **Companies adopting accessibility philosophy in their product and service design** If more companies were to integrate an accessibility philosophy in their product design if there would be a greater choice of more accessible and assistive products reaching the market.		
#19: **Separate the three pillars of a cost benefit analysis** Separate the three areas that are crucial before we are the launch a new product or service for the people belonging to a special interests group. Accounting - economic - social value convinces authorities in EU of the last pillar-its value could be more important after all.		
#70: **Consumers should not pay more for accessibility** Regardless of development/manufacturing costs etc., accessible products and services should be priced at the same level and non accessible products, so that they can complete on the basis of fundamentally etc. rather than by price.	yes	no

Table 24: Mechanisms of Cluster 3: Future improvement

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#5: **Focus on novel and creative designs** Stop re-inventing the wheel (as an opportunity for future generation) instead focus on identifying new, smart and creative solutions.		
#37: **Improve the level of technological research in inclusion**	yes	yes

Mechanism: ID – title – explanation	ACC relev.	AT relev.
Interest in technology transfer is created by the emergence of new technological solutions of relevant problems. Presently, many projects are based on incremental improvements of available technology and produce only marginal advantages for end users, which do not justify the implementation of new equipment and/or services. It is therefore necessary to aim to the selection of research project that are based of real technological innovations and produce significant advantages for users.		

Table 25: Mechanisms of Cluster 4: Market support

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#6: **Include and monitor business models when initiate development projects** The aim is to reach a market, sometimes we show possibilities. Good ideas come to some type of prototype and stop there. Which project to finance is to already then evaluate how it can reach the market in the future so that from the beginning one can see that e.g. it's too expensive or doesn't meet the user needs. Find a model of evaluating projects in an early stage		
#7: **Maximize potential user base for accessible products** I want to produce products that help people with disabilities. To work with developers to help look at the widest range as possible. Developers often see their potential market as defined disability groups whereas in reality there are many other 'non disabled' possible benefactors. There need to be identified and qualified.	yes	no
#8: **Identify and put in place rewards for market placements of products** Funding mechanisms should be amended to only apply financial support to organizations or companies after they have successfully placed an accessible/ assistive product on the market for a defined period of time, with defined measures of success. Similarly other incentives should be put in place, such as tax credits, etc, to support companies after they have successfully brought products to market. This is relevant particularly for SMES.		
#13: **Progressive financial support to marketing assistive ICT** Progressive financial support to marketing assistive ICT. Put the stress on the last part. The idea is to be progressive in financial support. Emphasize on financial support. Financial support should be progressive.	no	yes
#20: **Offer incentives to suppliers who offer effective accessible products and services** tax incentives, etc to companies who don't currently offer these products.	yes	no
#27: **Fund the development of broker agencies for accessible products** Funding should be made available to 'kick-start' an industry sector that would specifically provide support to companies/organizations engaged in technology transfer of Accessible and Assistive ICT. These specialist agencies could bring stakeholders together, guide marketing identify markets, customers, etc. They could be based as a similar model to the Rehabilitation Engineering resource centres in the US.	yes	no
#44: **Provide incentives to bring academia, industry and users together** Same technology designed by different groups in isolation. Robust methodologies for design should drive technology design. User at the centre of design.	yes	yes

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#46: **Provide accurate potential user data to developers** Directly aimed to marketing; what kind of marketing info; put it in that form; why should we develop this product. Organize market data into meaningful form. Make clear the potential market if the product is truly accessible.	yes	no
#49: **New funding mechanism to assist in exploitation - commercial introduction phase** The idea is how the transfer to the market of an exciting product breaks down at the end of the project when all exciting potential are demonstrated. The product dies. We need a new mechanism to look at that phase; within same instrument or innovation partnerships; auction of ideas. Cluster of projects finished and open them up for industries to come in and take them.	yes	yes
#50: **Understand the market dimension: local versus global** At the moment, the market for assistive ICT in Europe is rather a local than a global one. None of the (presumably three) enterprises with a perspective to reach out for global markets (Tunstall, Philips, Bosch) has been successful in doing so – and this is due to the fragmented market. Fragmentation occurs in regional responsibilities for health care that leads to regional regulation or regional reimbursement and business models; except the UK where the NHS is a monopoly health insurance that invested in a major roll out of Tunstall telemonitoring devices. Taking the example of telemonitoring, it can be said that technology successfully operating in the US market fails a successful introduction in Germany. Due to the fact that telemonitoring devices are not refunded by the social health insurances. The market dimension for health technologies has a crucial impact on the successful implementation, and as we do not have a sufficient understanding of all influential factors, we need to have more evidence on the market dimension; we need to analyze barriers as to understand the market.		
#61: **Analyze procurement methods in member states**	yes	no
#74: **Access to results for a broad range of companies** Many European and national R&D projects yield results or know-how related to accessibility. However, especially for small ICT companies it is a big problem to get an overview or even to become aware of such new findings. An open repository of findings of projects concerning accessibility, but also of technical solutions could support the TT from (EU) projects to those companies.		

Table 26: Mechanisms of Cluster 5: Awareness

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#16: **Increase positive contribution to fill the gap between assistive and mainstream technology** Nowadays we still have a generalized opinion that assistive technology and mainstream technology are 2 separate worlds that cannot be addressed simultaneously and be part of the solution of technology transfer and of disabled people inclusion.	yes	yes
#17: **Improve education and training about inclusion of people working in industry dealing with mainstream.**	yes	no
#22: **Support users to demand accessible products and services** If user organizations are funded to train and support their users to better		

Mechanism: ID – title – explanation	ACC relev.	AT relev.
understand how to demand accessible products and services, companies will more likely meet the market.		
#23: **Support user involvement in all phases of product life cycle** Usually when goes to industry it leaves out particular issue (probably due to cost) that are small but vital for accessibility. Involving users in the whole procedure will eliminate the danger of losing accessibility at the final stages.	yes	no
#24: **Create awareness and fight discrimination** As a means for increasing acceptability adoption of these technologies		
#36: **To improve the knowledge of technology potential to support an inclusive life** If there is more information about how technology may contribute to participation mainstream and inclusive life styles it will be possible to have more demands concerning technology transfer serving those aims and a more positive look to the users, who may also support it because the accent is not on the a lack of competencies but on contribution to do / to perform better.	yes	yes
#39: **Educating people to actively use technology breakthroughs** Educating people with special needs to actively use technology breakthrough. Trying to make public to groups of people with special needs of the accessibility of technological developments in their area of interest – lobbying to EU relevant bodies.		
#54: **The industry should be aware of the user needs of all** Work is going on within ISO/IEC Joint Technical Committee no. 1 (ISO/IEC JTC1) on the user needs, which have to be taken into account when specifying products and services enabling accessibility for all. The Special Working Group on Accessibility of JTC1 has specified a Technical Report stating user needs for people with some reduced functionality. The industry should consult this list when designing their products.		
#55: **Make basic research researchers aware of the application field of accessibility** One step of TT is the step from basic research to applied research. According to our observation, basic researches have low awareness and little understanding of ‘accessibility’. Basic researches could: (1) do more work in accessibility related issues of their basic research and (2) consider ‘accessibility’ as an application field of their research results.		
#57: **Improve distribution of information outside the group of people working in the inclusion environment** Mechanism for knowledge accumulated in EU projects to be distributed to all interested parties. In Europe many SMEs exist, who produce equipment and services and cold take care of inclusion problems, if they would be aware of the problems themselves and could have access to the available results aimed to solve them. Therefore, mechanisms for a wide and specific distribution of information about problems and possible solutions should be envisaged.		
#71: **Success stories needed** We need success stories for successful technology transfer. The word will spread. Also - we could analyze success stories. What was it that made this particular transfer so successful?	yes	yes
#84: **Embedding accessibility in engineering curricula.**		

Mechanism: ID – title – explanation	ACC relev.	AT relev.
Many accessibility issues are related to lack of awareness/knowledge by the product/service design team. Embedding accessibility/ DfA in the engineering curricula would improve this situation.		

Table 27: Mechanisms of Cluster 6: User needs

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#10: **Studies that demonstrate the positive contribution of Assistive and Accessible ICT** Stakeholders in Assistive or Accessible ICT often don't know the answer to the question: What is in it for me? Enterprises don't have clear answers on the business models that they must develop: they don't know the future development and perspectives of the area. Thus, more studies are needed that contribute to the potential of using assistive ICT and shift decision making from educated guesses to evidence based. The studies should deliver proofs of positive contributions of using Assistive and Accessible ICT for users regarding the increase of self-determinism and independence, entrepreneurs regarding economic advantages in order to reduce the risk of market failure and encompass investigations on the reliability/robustness of the ICT based solutions.		
#26: **Analyze user base by functional needs only** Situations where looking at requirements, needs have been presented by persons who have some sort of disability themselves. We need a broader application. Example: working in a group he realized that what those with disabilities need applies to many other people with similar needs.		
#31: **Gain deeper understanding of personal barriers** Point of view to be able to personalize, quite difficult, one person might not be willing to admit he needs special device or cannot buy. It should be clear I could use technology available but to find guidance to the process. To be able to personalize ICT products and services, for example a barrier for one person could be that he is mentally not ready to admit needing help (solution could focus on community) another person might not be able to acquire a service at a local provider. Knowing the exact problem is needed to solve it, and what technology transfer is needed to focus the transfer and to know the ultimate goal.	yes	yes
#43: **Examine how guidelines for assistive technology inform best mainstream ICT products and services** The idea is to use knowledge from the development of particular and personalized assistive technology products and services, to the development of more general and mainstream Accessible ICT. Coming from the specific to the more general, that will aim to a greater number of users, not specific to particular disabilities.		
#45: **Not only accessibility but also usability** Often we use the word accessibility which has man different meanings; things can be accessible but not being used; I want to make sure we also mean we use them.		
#62: **Translate user needs into product design** This relates to the difficulty for industry and designers to translate a set of user needs into meaningful design specifications.	yes	yes

Table 28: Mechanisms of Cluster 7: Technical Design Requirements

Mechanism: ID – title – explanation	**ACC relev.**	**AT relev.**
#12: **Open interfaces that allow products and services to interact** Mainstream products and services should provide interfaces that let them interact in a seamless way with other products and services including AT.	yes	yes
#21: **Consistent adaptable user interfaces should be mandated for EU projects** Older and disabled users would benefit from consistent user interfaces, which can be personalized to meet their individual needs (which may change with time or circumstances). Implies funding for scientific research to develop the specifications for such interfaces.	yes	no
#25: **Personalization for all and open interfaces when needed** Today the markets for assistive ICT and mainstream products and services are very separate. It is a gap between the two types of markets and these results in specific solutions even in cases when general solutions would help a number of users. Assistive ICT do not interest the large majority of people in society. If the market for mainstream products and services focus more on the possibility to personalize the settings for all users it will lead to more accessible solutions. For instance a businessman in a noisy environment could prefer information in text instead of audio at certain times. It is not possible to include all functionality in mainstream products and services. It would lead to much more expensive solutions. When a mainstream product or service do not offer needed functionality for all user groups it is vital that the mainstream ICT solutions include open interfaces to offer interaction with assistive ICT. For instance it should be possible for vision-impaired people to connect a Braille keyboard to a mainstream product.	yes	yes
#33: **Promote interoperability of accessible products and services** Standards and guidelines to promote interoperability; reduce the cost; existing technology could be used. Similar to Idea #12.	yes	yes
#63: **Ensure ICT reliability, robustness and security**		
#65: **Define technical interfaces between mainstream products and assistive technology products** Besides accessible HMIs applicable for the great majority of the users, there are some users who may be dependent on their customized assistive technology HW to operate various applications. Technical interfaces to AT products could make mainstream products and services accessible even to those who are dependent on such special HCI HW; e.g. a powered wheelchair user could operate also public terminal systems with the joystick of his wheelchair. A prerequisite would be that such technical interfaces are agreed (standard) between the mainstream ICT providers and the AT providers.	yes	yes

Table 29: Mechanisms of Cluster 8: Procedures

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#15: **Provision of procedures, easy to use tools and environments for accessibility testing** The provision of methodologies, procedures, easy to use tools, and test environments, including human experts, for the purpose of testing the accessibility of ICT products and/or services would support developers of such products/services in checking for accessibility features of their developments already during the development process; users, user organizations, or public bodies (public procurement) to check whether their requirements related to the accessibility of a given product or service are met, or to proof in an objective way that the requirements are not met.	yes	no
#35: **Provide standardized technical solutions or modules for accessibility in specific domains** Available technical solutions (including SW modules, technical descriptions, guidelines, technical know-how) developed and provided by accessibility experts make it easier for companies, who have no special expertise in accessibility, to achieve accessibility of their products or services.		
#53: **Specific methodologies and tools for the development of Accessible ICT** One of the reasons for tech transfer is because there are not adequate methodologies and tools.		
#86: **Environments for interoperability testing**		

Table 30: Mechanisms of Cluster 9: General accessibility

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#28: **Make it more general rather than specific accessible and assistive** ICT products should be incorporated into e.g. smart home, therefore market will be bigger, everybody will benefit. Making it more general technology rather than specific for elderly and disabled. Make the accessible assistive ICT products and services part of general technology e.g. ‘smarts home’. To increase market improve image and enhance technology transfer.	yes	yes

Table 31: Mechanisms of Cluster 10: Target groups

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#29: **Build a global public inclusive infrastructure** Building such an international infrastructure could help the AT industry to reach their market this refers to the GPII initiative	yes	yes
#30: **Implement the innovation partnership on active and healthy aging** Communication COM (2010) 546 final, published by the European Commission, presents the Europe 2020 flag- ship initiative “Innovation Union”. Annex III of this communication introduces “Aims and scope of a pilot European Innovation Partnership in the field of active and healthy ageing. This innovation partnership aims to overcome deficits in the current set-up of the technology transfer process, as it will be a top-level coordination structure that the EC wants to create by beginning of next year. EC is now developing more ideas on how to identify all relevant stakeholders. The innovation		

Mechanism: ID – title – explanation	ACC relev.	AT relev.
partnership follows quite broad objectives, as it includes questions of funding R&D, public procurement, standardization issues and also intends to intervene in the current set-up of business models in the health area. DG Infso and Sanco together stand behind this innovative partnership.		
#48: **Improve links with the e-health market** The e-healthcare services are becoming a great market worldwide. Therefore incorporating it into the healthcare sector it will improve technology transfer.		
#59: **Go to the kids. One student one laptop** In Cyprus there is an initiative to offer a free laptop to all kids over the age of 15 attending public schools. This should help them keep up with what is available in ICT, help educate them and give them ammunition and help them ask for what is available should they need any Assistive ICT or other technology. If this happens across all countries it will be a major breakthrough.		
#60: **'Green' agenda - footprint for usability** How can we use the analogous agenda we have for the environment to make it an agenda.		
#87: **Harnessing the green agenda and sustainability to promote the issue of accessibility** Finding a way to get leverage from the green/sustainability agenda could be a way to enforce technology transfer.		

Table 32: Mechanisms of Cluster 11: Policy

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#32: **Having accessibility requirements on all publicly available products and services** Legislation for requirements not enough; choose requirements whenever they are meaningful. If a private organization provides a service, it should also have accessibility requirements across all member states. The idea is to include accessibility requirements in publicly available services and especially in publicly supported services whenever this is meaningful.		
#34: **International standards must cover the needs of everybody** Many products will be based on international standards. Therefore standards makers should clearly state whether their standards meet the accessibility needs of all people including disabled people.		
#40: **Legislate in the right place** Legislation can be introduced at a national or international level ('different places'). The idea behind this mechanism is that a common set of legislation should be introduced across the EU 27 countries.		
#41: **Development of open standards for Accessible ICT systems based on sound scientific data** The present set of standards is often inconsistent, fragmentary and out of date (e.g. based on superseded technology). Often the accessibility aspects are superficial and do not reflect the unmet needs of the unmet user population.	yes	no
#42: **Accessibility criteria in public procurement policy**	yes	no

Mechanism: ID – title – explanation	ACC relev.	AT relev.
Basically having accessibility criteria means companies are given incentives to develop accessible products. Companies are given an incentive to develop accessible products if they believe they will win government contracts.		
#47: **Make the availability of accessible technology a human right** In line with the recently published UN convention on Human rights, I feel that this single factor would cause a 'tsunami' of new Accessible ICT products onto the market immediately. It would create a new model of technology transfer- namely 'technology rush'!		
#67: **Actually penalize countries, organizations and companies who don't implement accessibility and use the funds for R&D**		
#69: **Implement UN convention** Implementation of the UN convention that refers to e-accessibility and that has been signed by all the member states could be an opportunity to reinforce obligations and requirements on industry and public bodies. This could be a driver of technology transfer.		
#80: **Investigate whether patents are required to implement a new standard for assistive ICT.**		
#81: **Consistent legislation and/or mandatory regulation in the EU countries** At present different countries have different requirements for Accessible ICT systems for public use. This means that manufacturers have to produce different countries, hence increasing their costs. Government procurement policies vary from country to country.	yes	yes
#82: **Consistency in policies for subsidies of assistive products and services.** There are various mechanisms for subsidizing the cost to the end user for purchasing and running assistive devices. Even within one country, the same device may attract different levels of subsidy in different circumstances. For instance there may be a state subsidy for aids for employment, which may not be available to disabled people currently unemployed, but seeking employment. There is also inconsistency in who pays for the cost of training the disabled person in the use of the assistive device. All this variability means that marketing departments of mainstream companies are reluctant to market assistive products and services.	no	yes
#83: **Requirement for companies to publish their corporate social responsibility policies in respect of accessibility** Companies often have a corporate social responsibility policy. Only some of these policies mention accessibility and only some companies publish them. The idea behind this mechanism is that it should be a requirement on companies to publish them. It would then be possible to ask them if their accessibility policies were just "aspirational" or were being implemented.		

Table 33: Mechanisms of Cluster 12: Interconnectivity

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#64: **Focus on interconnectivity of technology** Cooperation is needed. Open your mind, think out of the box, try to strengthen by working together don't think your field of expertise is more important than another. Focus on how we can benefit from each other's expertise.		

Table 34: Mechanisms of Cluster 13: Positive monetary aspects

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#72: **Positive monetary aspects** For big companies it's often all about money. Are there any positive aspects of accessibility we can promote here or will assistive ICT always have to live with the prejudice that it's big expenses for only a handful of users?		

Table 35: Mechanisms of Cluster 14: Simplification of projects

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#73: **Small projects instead of big frameworks. Start somewhere through a pilot project to monitor easy to evaluate** Practically approached, company would rather grasp a good idea for an accessibility solution and implement it themselves instead of using big unhandy frameworks. Keep it slim!	yes	yes
#76: **Simplify the process within the commission before funding is approved**		

Table 36: Mechanisms of Cluster 15: Marketing

Mechanism: ID – title – explanation	ACC relev.	AT relev.
#75: **Marketing for accessible solutions** Marketing/PR is too often done in the wrong way or at the wrong place.		

Looking at the 34 most relevant mechanisms it is remarkable that only two of them

- #13: "Progressive financial support to marketing assistive ICT" and
- #82: "Consistency in policies for subsidies of assistive products and services"

are not significantly relevant for supporting the technology transfer in Accessible ICT because they are specially aiming at "assistive" ICT products and services.

In contrast to that, only 21 out of the 34 mechanisms are significantly relevant for supporting the technology transfer in Assistive ICT.

8.1.3. Influence graphs of mechanisms

For the 34 most important or influential mechanisms, influence relationships were established. (For instance, an **influence relation** from mechanism A to mechanism B indicates that progress in the realisation of mechanism A would have a positive / supportive influence on the realisation of mechanism B.)

These influence relations between the 34 mechanisms are graphically represented in Figure 9. – Three pairs of ideas are cycled together (7 and 70, 27 and 56, 12 and 29) which means that these pairs of mechanisms were found to influence each other, to receive and to exert influences from and to the same factors.

The participants of the first SDDP co-laboratory regarded the following four mechanisms the most influential and the stakeholders should give these a higher priority:

- #15: Provision of procedures, easy to use tools and environments for accessibility testing
- #44: Provide incentives to bring academia, industry and users together
- #23: Support user involvement in all phases of product life cycle
- #20: Offer incentives to suppliers who offer effective accessible products and services

The way this influence graph should be interpreted is that the actions, which aim to support these four mechanisms, will have the greatest influence in achieving large-scale organizational change. Progress made in these four mechanisms will create a positive chain of facilitation because they are influencing directly or indirectly practically all mechanisms that lie after them.

A detailed discussion of the various influence relations as presented in Figure 9 can be found in CARDIAC Deliverable D2.1 “Technology Transfer Influence Tree for WP1”.

Figure 10 shows the influence graph of the 32 mechanisms relevant for technology transfer in Accessible ICT and is of course quite similar to Figure 9.

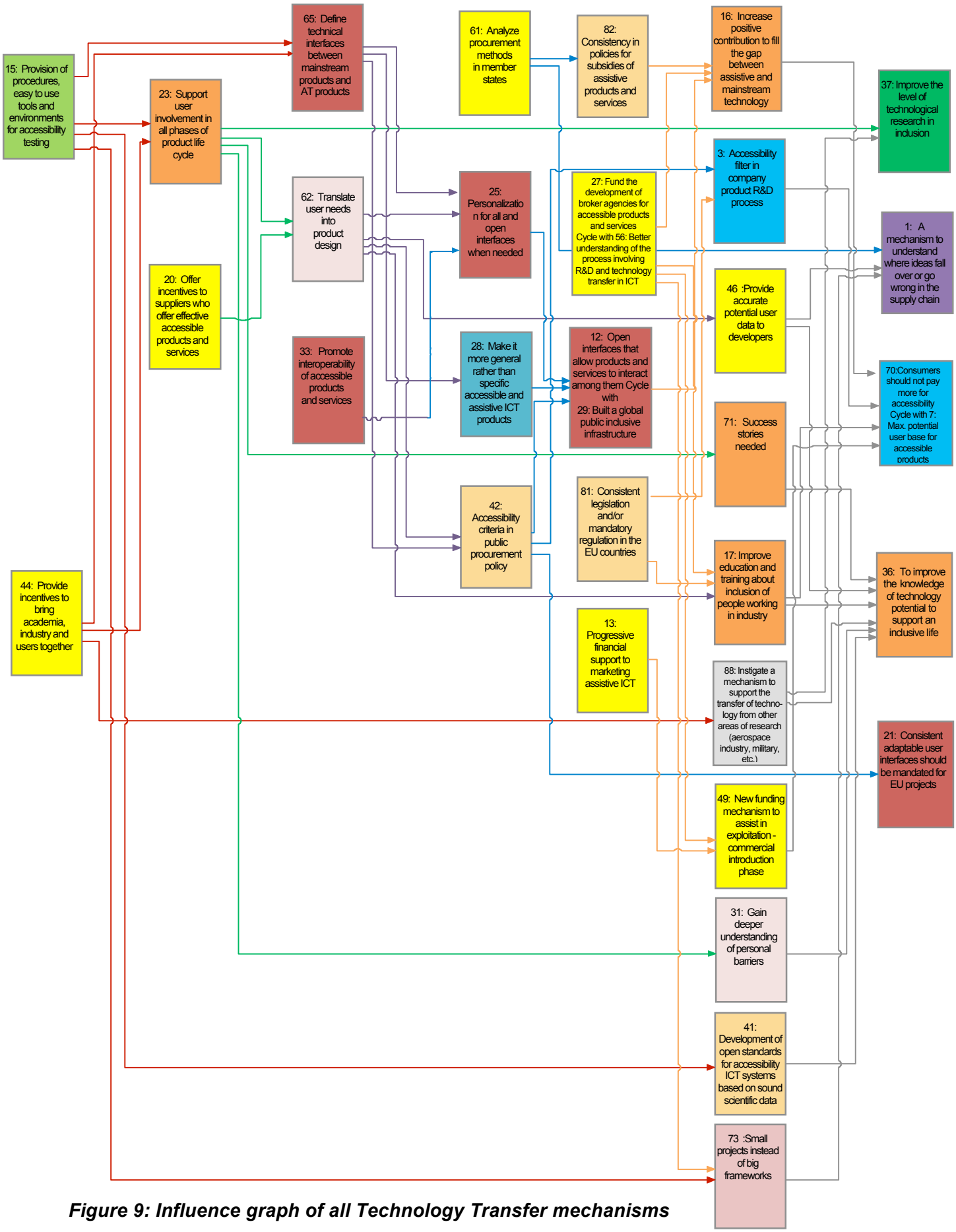


Figure 9: Influence graph of all Technology Transfer mechanisms

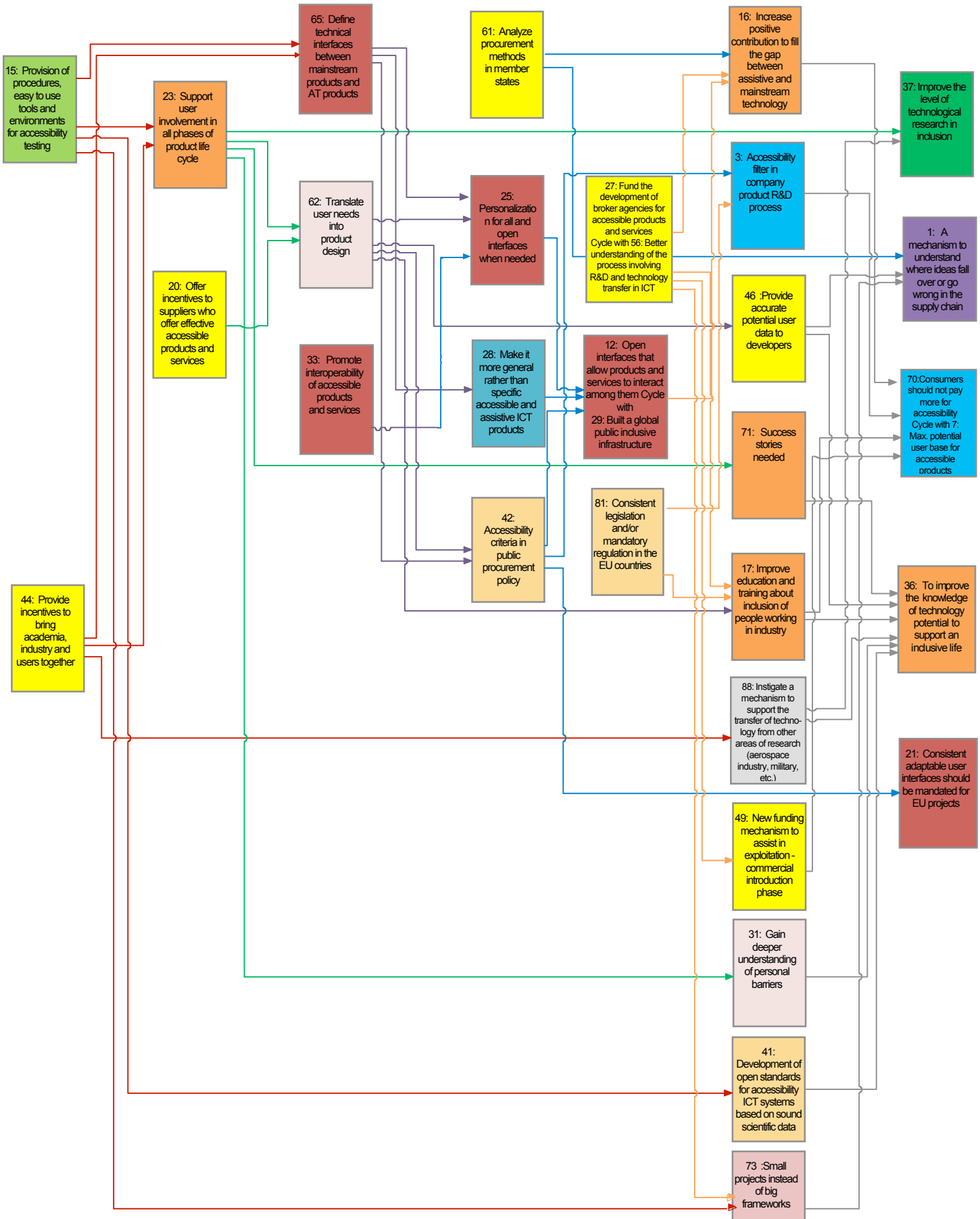


Figure 10: Influence graph of the Technology Transfer mechanisms relevant for Accessible ICT

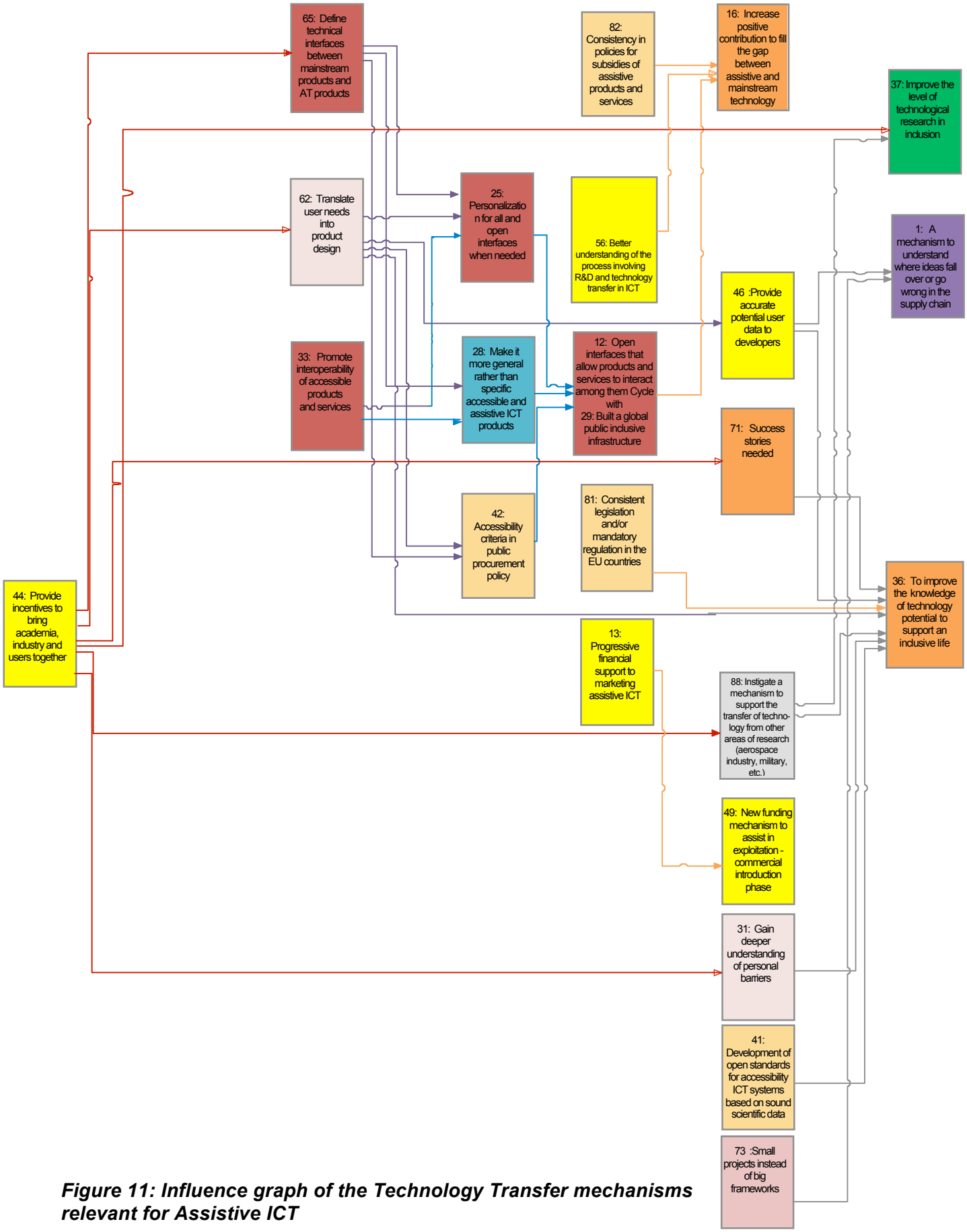


Figure 11: Influence graph of the Technology Transfer mechanisms relevant for Assistive ICT

Figure 11 shows the influence graph of the 21 mechanisms relevant for technology transfer in Assistive ICT which is, of course, only a sub-graph of Figure 9.

The following 13 mechanisms out of the 34 were regarded as not significantly relevant for technology transfer in Assistive ICT:

- #3: Accessibility filter in company product R&D process
- #70: Consumers should not pay more for accessibility.
- #7: Maximize potential user base for accessible products
- #20: Offer incentives to suppliers who offer effective accessible products and services
- #27: Fund the development of broker agencies for accessible products
- #46: Provide accurate potential user data to developers
- #61: Analyze procurement methods in member states
- #17: Improve education and training about inclusion of people working in industry dealing with mainstream.
- #23: Support user involvement in all phases of product life cycle
- #21: Consistent adaptable user interfaces should be mandated for EU projects.
- #15: Provision of procedures, easy to use tools and environments for accessibility testing
- #41: Development of open standards for Accessible ICT systems based on sound scientific data
- #42: Accessibility criteria in public procurement policy

There are various reasons for this:

- A general reason is the fact that AT products and services are not “designed for all” but for groups of people with a certain disability. An AT product aims at somehow compensating a certain disability. In this respect it is specialized; and therefore there is no need for a “general” accessibility of this product. (E.g. mechanisms #61 #42)
- However, accessibility can be a relevant feature of an AT ICT product in the context of its usage in combination with a mainstream ICT product. Some AT products directly interact with mainstream ICT products or services. In this respect they can achieve an indirect accessibility of the mainstream product – at least for the special user. It is assumed that open or standard (technical) interfaces between mainstream ICT products and Assistive ICT products would improve the situation of accessibility of mainstream products – and that it would be the main responsibility of mainstream ICT developers to provide such open interfaces. (E.g. mechanism #41)
- It is assumed that developers of AT are aware of the special accessibility needs of (their) handicapped customers – in contrast to the developers of mainstream ICT products and services. (E.g. mechanisms #3 #27 #46 #17 #23 #21 #15)
- It is assumed that “accessibility” (still) takes special or extra effort or consideration in the development process of mainstream ICT products and should be stimulated or supported, e.g. by financial means. (E.g. mechanism #20)

- Some mechanisms are just relevant for the accessibility of mainstream products. (E.g. mechanisms #70 #7)

Conclusions from the influence graphs with respect to AT and Accessible ICT

The 32 mechanisms for supporting technology transfer in Accessible ICT include almost all mechanisms for supporting technology transfer in AT ICT.

There are 19 out of the considered 34 mechanisms that support the technology transfer in both areas, in Assistive Technology ICT as well as in Accessible mainstream ICT. This could be a criterion for prioritisation.

The directed influence links in the influence graphs can be used to derive an order of influence which also can be used for prioritisation in time or in effort.

8.2. Selected results of the second SDDP co-laboratory on "Inclusive HCI research" relevant for technology transfer

The participants of the second CARDIAC SDDP co-laboratory in the year 2011, i.e. project members and invited external experts, shared 75 ideas on mechanisms in response to the triggering question "What type of research is missing that could facilitate development of inclusive HCI?".

(The methodology and results of the second SDDP co-laboratory, including discussions on the project's Wiki and in virtual meetings are described in detail in Deliverable D2.2: "Influence Tree on inclusive HCI research and development priorities for WP3".)

Although technology transfer was not in the focus of the second SDDP co-laboratoy, some of the ideas and clarifications that were elaborated are also relevant to aspects of technology transfer:

End-user needs that are known and respected

SDDP2#55: **Identify human factors barriers to health, education and participation of low income groups**

The opportunities created by digital technologies are not enjoyed by the whole of society; indeed, there is a strong correlation between digital exclusion and social exclusion. There are significant and untapped opportunities to use technology better on behalf of citizens, communities, and digitally disenfranchised groups. However, to achieve inclusion, systems must be created seeing the human factor as a part of an integrated solution from the outset, not as an adjunct but also not as a focus. In addition, the multiplicity and ubiquity of devices and their interfaces are key to successful inclusion, and systems must be tailored to what users actually require and will use; as opposed to what organisations and government require and use. For instance, uses on low income may not be able to afford general-purpose computational facilities and therefore it may be more appropriate to deliver applications and content via other mediums such as mobile devices, games consoles, digital television, or other as yet undefined applications and devices. Only by making sure there is access to, what now seems to be compulsory digital interactivity in areas

such as education and health care, can we make sure that the next generations have better chances than the current one.

SDDP2#60: **To promote common research on user needs and preferences to be used by all e-inclusion projects**

When most of the European projects that are dealing with accessibility start, they first carry out a study on the state-of-the art and user needs and preferences so that they can identify their limitations, their desires, their needs and their preferences. The main problem is that most of the time, this effort is done several times and we are effectively reinventing the wheel and we are wasting effort that could be more efficiently redistributed amongst the projects. So the idea is to have a common research and database where user organisations and technological partner look for the accessibility of the different ICT and assistive technologies so that they can identify these preferences, needs and limitations. This information could then be provided to all the other projects dealing with accessibility so that they can use this state-of-the-art as an input into their project.

SDDP2#64: **Basic research needs to be made on AT abandonment/ adoption**

There are only a handful of papers on AT abandonment, mostly form the 90's. In order to fully address the distressing level of AT abandonment (40-70%) a principled, longitudinal research agenda of this phenomenon, segmented by AT and user type and compared to similar non-AT systems needs to be set out on. The implications of the resultant body of knowledge could potentially deeply affect AT form design to marketing.

Awareness – knowledge – skills concerning

SDDP2#4: **Design clearing house for inclusive HCI**

A clearing house is an online information transaction process for bringing together a wide cross-section of design methods, relevant standards and existing products as well as ongoing research. A design clearing house for inclusive HCI will draw together valuable information online so that companies can quickly and clearly understand inclusive HCI. Commercial companies have limited time to develop interfaces and to encourage them to use inclusive design practices, a central place online with impartial information would be valuable.

SDDP2#42: **Research on reasons why existing knowledge and standards on accessibility are not known or applied by HCI developers**

SDDP2#49: **Research that promotes inclusive practices of professionals responsible to develop new products or services**

It is important that we can find ways to motivate professionals to use the knowledge and inclusive practices (e.g. standards, research findings, etc.) to develop new products or services, or else the accessibility and usability will always have problems.

SDDP2#54: **Research on how to increase and widen accessibility in professional education**

Procedures – tools – methods – environments

SDDP2#7: **Promote research in methodologies and tools for HCI accessibility evaluation, including, monitoring and benchmarking**

Even if the Web is far from being universally accessible, it is one of the environments were accessibility requirements are better known. The reason is the availability of accessibility guidelines to help the designer and the evaluator. They also allowed the creation of semiautomatic accessibility evaluation methods and tools. A similar set of clear and unambiguous accessibility guidelines would help to advance in accessible HCI evaluation.

SDDP2#10: **Facilitate the creation of digital accessible materials to non accessibility experts**

The HCI can be accessible but if the contents produce are not the accessibility will be compromised. So there is a need to create tools to help authors to produce material/ contents that are accessible to all, if they don't have the skills to do that.

SDDP2#11: **Promote tools for decision making in the user-centered design process**

A lot of methods and tools are available to guide the user centred design process in the early stage of the process. For example methods are available for participatory and co-design. These methods are suitable until the prototype stage. To take the step from prototypes to implementation in real life situations additional tools are necessary. There is a need for tools that facilitate the decision making process between different stakeholders in the final stages of the user centred design process. These tools should guarantee equality between the inputs from all stakeholders, facilitate cooperation and provide guidelines to look for alternatives and compromises when requests from stakeholders are not aligned.

SDDP2#26: **To develop more specific and clear accessible guidelines for application developers**

One of the main problems when integrating a new accessibility solution within mainstream ICT is that the guidelines and references that the developer has as his disposal to create accessible applications are very complex, very difficult to use and at a very high level. They are really explaining how to they should be used for a specific use case of the applications. It therefore takes a lot of time fir the developers to create these accessible applications and very often they do not provide accessible solutions because they do not have the time to do it. Therefore, if more specific guidelines could be provided that are targeted towards what developers really do, i.e. referring to the specific tools they are using for these applications, such as for example, eclipse, Netbeans, visual studio or the adobe tools, it would be much easier for developers to create accessible solutions thus increasing the chance of a greater number of applications being created that are accessible to mainstream ICT.

SDDP2#29: **Research methodologies that efficiently collect data about users including existing HCI quantitative tools (like needs, skills, interests, limitations)**

SDDP2#46: **Promote interoperability among devices and services to enhance accessibility**

Many services available to people with disabilities have very different interfaces that are frequently incompatible among them. The idea behind this proposal is to make compatible and interoperable all the equipment available to each user. The ideal scenario is to provide access to all services by means of a single interface (well adapted to the user). This interface would be available in the different devices that are handled by each user (supposedly well adapted to the features and needs of the specific user). That may require promoting the definition or adoption of a common/standard middleware as accessible interoperability framework.

SDDP2#63: **Research on automated evaluation aids**

Although it would be ideal if everyone had a crack team of specialists to evaluate their needs and make recommendations for accessibility solutions, we do not have anywhere near the number of such specialists as are needed to address everyone who needs special interface assessments. In addition the specials we do have trouble keeping up with everything that is available.

Research is needed on the development of evaluation wizards that can be used both with and without professional evaluators to help users figure out what types of solutions would be best for them. Where professional evaluators are available these wizards can help to make the evaluation process go more quickly and provide ways to try out ideas with users. They can also help suggest new interfaces that the evaluators may not be familiar with but that should be considered allowing evaluators to keep up-to-date in this rapidly changing area. For those who cannot afford or who live in a place where evaluators are not available, use wizards can help people become familiar with different techniques or strategies that might address their needs.

All of this is much easier to say however that to do in the evaluation process can be quite complex. So while there is great need and potential for this is also a very difficult area. This would make it a difficult but high payoff and high need area of research.

Technology transfer networking between stakeholders

SDDP2#47: **Research on methodologies to analyze collaborative accessibility and undertake collaborative user- and usage centered design**

Social approach to better collecting end users' requirements and opinions, as well as evaluating prototyped UI solutions, (for example, using web 2.0 facilities).

Collaborative approaches to web accessibility start by identifying barriers by disabled people themselves and raising the social pressure for example on website administrators. Best practice examples of such collaborative approaches are web sites (e.g. IBM's work, or the FixTheWeb initiative) used for "fast and easy" reporting accessibility issues of online services and content but also detailed information about how to fix problems. Similarly, a geographical information system for mobility impaired people may allow to collaborate actively by identifying wheelchair accessible/non accessible locations. A system may allow collaborative correction of speech recognition captioning of audio recording for educational purposes, and whose editing of captions could be provided voluntarily by hearing class mates when funding for professional captioning was not available. All these are existing good examples for Web 2.0 services improving accessibility through "crowd sourcing". If such approaches will scale up to the extent and quality of commercial services like Facebook and large voluntary organizations such as Wikimedia is unclear and requires further analysis, involvement of end user organizations and implementations.

SDDP2#75: **Create development environment for accessibility solutions**

We have an incredible resource in professors, students, clinicians, and consumers with ideas on how to create new or improved accessibility solutions. However it is often very difficult to do all the work needed to build them from scratch. It would be much better if these individuals had an environment where they could realize their ideas without having to write massive amounts of code. Apple has had great success in creating a myriad of new, creative, (and some not so creative) solutions by providing a development environment that made it easy to create applications in a rich set of tools to build them with. It is possible to create applications in as few as three days. – By creating open source platforms that can be easily adapted by researchers to create functional solutions we can tap this creativity more easily in the more ideas get to market.

Market and market supports

SDDP2#61: **Ways to move from purchase to lease or renting accessibility and assistive technology (exploring market, policy and technology challenges)**

In the recent years we talk about software-as-a-service while for several decades now we are all used to the concept of leasing a car or equipment or a house. So it seems that it is high time that we make the transition towards new ways to move from purchase to lease or renting accessibility and assistive technology. Why own a communication aid if you can lease one? And why own a navigation system for blind or elderly while renting one as a service? Social insurance agencies may also have their own views on this – it may prove more cost-efficient for them both for the long run and for an immediate introduction; however there is need for exploring market, policy and technology challenges and dynamics. Finally accessibility matters here again: if you leave the ownership model to move to the leasing or renting, you need intuitive accessibility in the offered solutions as your users don't regard anymore the learning of the system as an asset. As long as you may use a system for a few days or weeks, it needs to be easy-to-use and make the life of the user easy regarding manipulation and maintenance.

SDDP2#70: **Research on how to make accessibility simpler to deliver, apply, configure, support and use and explain to policy makers**

- simpler for users to figure out what meets their needs
- simpler for companies, schools etc to apply it, and maintain it
- simpler for users to install, invoke, configure
- simpler to (re)apply across all the technology that people encounter

Policy to support technology transfer

SDDP2#69: **New mechanisms for international collaborations**

There is tremendous need and limited funding in the area of accessibility. The European funding model has created a mechanism for international collaboration within Europe but mechanisms are needed to prevent duplication of effort and to allow closer collaboration between all nations in this area. – Pooled funding and cross jurisdiction funding are both extremely difficult. However other mechanisms might be explored. Some of these might involve common roadmaps and research platforms. Others may indeed involve international collaborative efforts among funding agencies. – We should explore this to find better mechanisms for building on each other's research in a coordinated fashion.

SDDP2#71: **Research on sharing accessibility knowledge with developing countries**

Few researchers in developing countries such as Thailand or China are investigating accessibility in their culture, using their own language and develop an understanding of the processes involved in creating a sustainable impact. Often the economics is much more demanding low budget solutions. The development of eScience has shown in the past an approach to create distributed research groups. Developing countries may become involved in research on accessibility of training material is provided, best practice approaches described and pitfalls are expressed.

8.3. Technology transfer in mainstream ICT companies – Results of a structured interrogation of companies

8.3.1. Background

A survey was conducted with a view to providing best practices in Technology Transfer (Knowledge Transfer/ Open Innovation).

We looked at market factors and economic requirements relating to the development of Accessible and Assistive ICT products and the process of technology transfer, (the sharing of skills, knowledge technologies methods in manufacturing) in the area of accessibility and universal design, with a view to analysing best practices in technology transfer in mainstream ICT Companies.

8.3.2. Key Survey Objectives

- To discover what processes, mechanisms and tools are used in TT
- To discover what are the main issues industry sees with TT
- To ask what actions/support do ICT's suggest from policy makers to improve TT

8.3.3. Methodology

A series of online, paper and telephone interviews were conducted with mainstream ICT's. Key representatives from Siemens, Technalia, Vodafone, Technosite, Oracle, SAP, Phillips, O2 and Swedish Post & Telecoms were invited to participate, as were a number of other organisations and universities.

8.3.4. Data Collection Process

75% of surveys were completed in Word and returned via email, 25% conducted by telephone.

8.3.5. Questionnaire concerning technology transfer in Accessible ICT

In the following the essential parts of the questionnaire are listed:

Introduction

Our aim is to create a platform that can bring together the various stakeholders in the area of Accessible and Assistive ICT with a view to identifying research & development gaps and emerging trends, and generating a research agenda roadmap.

Part of generating this roadmap is to look at best practices in Technology Transfer.

Technology Transfer (TT) – Best Practice

This survey aims to look at best practice in Technology Transfer (Knowledge Transfer/ Open Innovation). We have adapted the questionnaire from a model developed by Lane and Rogers (Implementation Science 2011, 6:106).

We are looking at market factors and economic requirements relating to the development of Accessible and Assistive ICT products and the process of technology transfer, (the sharing of skills, knowledge technologies methods in manufacturing) in the area of accessibility and universal design, with a view to analysing best practices in technology transfer in mainstream ICT Companies .

Thank you for your input. It is most appreciated.

Questions – Section One

Question #1. What processes, mechanisms and tools does your organisation currently use in TT (intra/inter)?

Question #2. What are the main issues your organisation sees with TT?

Question #3. What does your organisation consider Best Practice in TT?

Questions – Section Two

Question #1. Relative to other activities, how frequently does your organisation engage in measuring the success/failure of technology transfer?

Question #2. hat sources does your organisation search when identifying latest technology transfer information?

Question #3. Relative to other activities, how frequently does your organisation engage in translating knowledge from Research activity?

Question #4. Please describe any incentives that your organisation uses to encourage your internal associates or members to become aware of, or apply new research-based knowledge to TT.

Question #5. How do you strengthen the role of end-users and their needs?

How do you know about user requirements concerning accessibility? From which sources?

Do you involve end-users in the development of your products/services in order to make your products accessible? How? At which stages?

Do you consider your knowledge / the general knowledge of accessibility needs and requirements as sufficient? - Do you see a need for improvements? Do you have suggestions for improvements?

Question #6. How do you create an infrastructure for awareness, knowledge and education on accessibility and Universal Design in ICT

Does your staff have any training etc. in "accessibility and corresponding user needs"? Which?

Do you see a need for or have a suggestion for education/training in accessibility and Design-for-all issues? Which?

In case training courses/material on accessibility would be offered, how would you like to receive/use it (in-house training, external courses, online courses, written material)?

Do you need support in technical know-how provision concerning accessibility, e.g. a pool of knowledge, an information service, expert services ?

Question #7. What tools/instruments that facilitate the realisation of accessibility in ICT products and services does your organisation use?

Do you use or apply any tools, procedures, environments, guidelines, standards etc. to achieve accessibility of your products? If so, which?

Do you see a need for more of such instruments? What is your need?

Question #8. How do you ensure that you continue to establish a culture of Universal Design?

How important is "accessibility" of your products be regarded in your company?

Is accessibility / Design-for-all part of your product philosophy?

Do you regard "accessibility" as a quality criterion of your mainstream products?

Is accessibility check part of your quality management process?

Question #9. Establishing collaborative environments – how does your organisation support the technology transfer between stakeholders concerning Accessible ICT?

How do you cooperate with external partners or institutions concerning TT in accessibility/ Design-for-all?

Do you see a need for more cooperation or coordination of TT activities?

Question #10. Prepare accessibility for the market – Prepare the market for accessibility

How far are you aware of the market demand for accessible products/services?

Do you see a need for more information? Which?

Question #11. What can policy makers do to practice a policy of “accessibility”?

What kind of action or support do you suggest from policy makers to improve TT?

8.3.6. Snapshot: Random selection of findings

The following comments have been randomly selected from all the returned surveys to demonstrate the range of practices/views in mainstream ICT.

Question #1: Processes, mechanisms, tools used in TT

Respondent A: Development of technology for other companies via subcontracting.

Patents, Spin offs (infrequently), Open source technology developed in EC projects (AAL, FP7, Artemis etc)

Respondent B: The collaborative projects (whether European or national) are the most used tools for TT. Through the collaborative R&D, the knowledge of the Universities and Research Centers is adopted and aligned to the market interests of our organsiation.

Hiring researchers from Universities or Research Centers with the expertise that we are looking for is also used.

Participation in international workshops on the topics of interest.

Technology watch in several topics related to our mean areas of interest.

Contracting experts as freelance to carry out a specific task where they have the expertise is also used. However, this option usually does not provide us with the expertise required for continuing with its business, and works only on punctual issues.

Respondent C: Product quality is key. We have two teams – accessibility team and lab team. Also use decentralised teams world wide. Accessibility training, documentation and guidelines along with automated testing are processes we use.

Respondent D: We have created an Accessibility Competence Center in 2000 supporting the different divisions, units and departments of our organisations and their consumers' in the field of accessibility. The ACC is comprised of 6 accessibility experts (3 of them blind or visually impaired) and up to 6 technical staff. The covered products range from hard- and software, mobile apps, household appliances, public transport (trains), work places, smart grid, smart home, e-health etc. The mechanisms for implementing accessibility features are very different and highly depending on the product and the customer engagement. Only in the field of household appliances we are selling to the so called end user. In this area we have developed a mechanism to support accessibility in the standard product development and quality process (nothing special!). But in most cases we help our customers (e.g. banks, service providers etc.) to create and run accessible services for their end users (project specific accessibility specifications and tests). Moreover, the ACC is actively engaged in international standardisation and rule making in the field of accessibility. For example see EU Mandate 376: http://www.mandate376.eu Finally, the ACC team is engaged in national (German) and European research project related to accessibility.

Question #2: Main issues with TT

Respondent A: Real marketability discovery

User needs & wants

Respondent B: Often, the knowledge we obtain from the Universities and Research Centers (based on basic or applied research) is in a non-mature stage and requires of a large amount of additional research before starting the development of a prototype. Not many Research Centers have shown their capabilities for working in close-to-market prototypes.

Usually, the knowledge provided by the Universities and Research Centers are in the persons carrying out the job. Therefore, when the projects are over, much of the knowledge is not kept inside

Respondent C: So much new technology and continuous change. All these little changes cause problems for example so many browsers and documentation not available to show detailed differences between them.

Have to find our own solutions which can be timely and costly. Software laws different in different countries and we must comply with all. Very complex at times. Continuously have to inform developers/customers of ongoing changes.

Respondent D: The development of new Technologies does often not include the aspect of accessibility from the early stage.

Assistive technology seems to be at least 3 years behind up to date technology. Tendency: growing gap!

Accessibility will be a criterion in public procurement in Europe. This will hopefully improve accessibility as long as this process will be harmonised (no market fragmentation) and the mechanisms for assessment are not increasing cost significantly (Self declaration of conformity versus third party certification).

Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the price or the burden (time) of always learning new things without an obvious benefit for the person. User argument: "never touch a running system".

Accessibility is no longer alone in the responsibility of the manufacturer of a product or service. Network or content provider need also to support in an accessible way. And, in the world of social net works, any idiot can decrease or increase accessibility (without knowing anything about it).

Many older persons or person with disabilities have problems to adopt and understand new technologies. They often are not able to judge risk/benefit of social networks, buying or banking online.

Question #3: Best Practice in TT

Respondent A: Pre funded research

Subcontracting for others

Respondent B: An external/internal expert has an idea on a new business line.

The SoA analysis shows that there are not mature R&D on the topic.

Through a research project, the idea evolves to a set of specific developments tested as proof-of-concepts by co-creation with Universities, Research Centers, and potential client.

These specific developments are further developed beyond the research project results by means of internal resources to reach the maturity required for being deployed in real-life settings.

Through a deployment project, and jointly with Research Centers and potential clients, the mature prototypes are deployed and tested in real-life settings, and improved according to the test results (and the business models are designed).

The resulting products and services are incorporated into our business portfolio.

Respondent C: Goal is to automate as much as possible. Build access into all technology so that developers cant avoid accessibility. Inform developers how to enable features on guidelines etc.

Respondent D: Not each engineer, software developer and designer can and must be an expert in accessibility. That is the reason, why we run the accessibility group which provides the project specific accessibility knowledge and training to the required extend in a most efficient way. Similar approaches are used for other topics like usability, safety, energy consumption etc. Accessibility is one of many criteria for a product or service but not treated different. We are seeking for accessible solution which are readily achievable and affordable for a reasonable price.

Question #4: How often do you measure success/failure of TT

Respondent A: Frequently

Respondent B: rarely measure the success ratio of the technology transfer

Respondent C: frequently

Respondent D: N/A

Question #5: Tools searched for latest TT information

Respondent A: Academic Journals, White papers, Training & Conference & individual experts

Respondent B: Academic Journals (online or print), White papers or other in-house reports from other organizations, [Newspapers or Magazines, Websites, Trainings or Conference, Individual Experts

Respondent C: Newspapers, mags, websites, trainings, individual experts

Respondent D: Academic Journals (online or print), White papers or other in-house reports from other organizations, Newspapers or Magazines, Websites, Trainings or Conference, Individual Experts

We are using the contact to organisations of older persons and persons with disabilities, companies providing assistive technology, and University research.

Our main source are international Standards and so called industry agreements (no official standards).

Question #6: Translate knowledge from research activity

Respondent A: Occasionally

Respondent B: Occasionally

Respondent C: Rarely

Respondent D: N/A

Question #7: Internal incentives to apply new knowledge to TT

Respondent A: Workshops, Webcasts or pre-conf training

Respondent B: Certification of Completion/Attendance, Discount on advanced conference registration, Offering Workshops, Webcasts or Pre-Conference Training

Respondent C: No, expect it

Respondent D: Our Corporate Technology is a unit of the company responsible for technical innovations, approval of new concepts, transfer into new products, creating patents and IPR etc.

Question #8: Strengthen the role of end-users and needs – Requirements concerning accessibility – Involve end users – Knowledge of accessibility needs sufficient

Respondent A: Research projects, work with end-users and end-user organisations.

Requirements gathering at all stages (iterative design process

Yes – sufficient but could be improved upon with further contacts with manufacturers and standards organisations

Respondent B: We are a company working in the field of the social economy. Over 50% of our staff are people with disabilities and it is precisely this which gives us our competitive edge, since all our technological development and consultancy activities are carried out with accessibility and design for all criteria. Since 2001, we have provided consultancy, training, assessment and certification in accessibility issues. Another business area Technosite has developed is that of social studies into the needs and preferences regarding the use of technologies among different groups of users with special needs.

Do you involve end-users in the development of your products/services in order to make your products accessible? How? At which stages?

The end-users are involved in all stages of the development process: the end-user requirements gathering, co-design, validation of mock-ups, testing of prototypes in controlled environments, testing in real-life settings, etc.

Do you consider your knowledge / the general knowledge of accessibility needs and requirements as sufficient? – Do you see a need for improvements? Do you have suggestions for improvements?

We are continually improving our knowledge on the needs and preferences of disabled people and the elderly.

Respondent C: Have user groups who report back on a continuous basis and comply with WCHG and other regulations. Also partner with user organisations for feedback.

Yes – good but always room for more

Respondent D: The in-house concept of the ACC was described earlier and also our contribution to research and standardisation. We are cooperating with the Company Professional Education department to teach about accessibility. We have also a cooperation with the university of Paderborn (we are located in one of the university's research buildings).

Finally I'm presenting our organisation in national and European industry associations like BITKOM (chair of the accessibility working group), DIGITALEUROPE, CECED and others and I'm also chairing the national standardisation group at DIN which is mirroring most international accessibility standardisation groups.

Anyway: there is always the opportunity to extend efforts on accessibility. Often I have the impression that we talk too much about accessibility instead of working on accessibility!!!

The funding scheme of R&D projects should be aligned to better performance.

Question #9: Infrastructure for awareness on accessibility and universal design in ICT – "Accessibility and corresponding user needs" training – Education/training in accessibility and design for all – Accessibility training offered, how would you like to use/receive – Require technical know-how concerning accessibility

Respondent A: Yes – ongoing from academic work

Better boundaries on DFA approach – it too easily degrades into exhortations to be nice and as a result, is difficult to operationalise

Yes, to a limited degree. We also do internal

No, we have good access to existing sources

Respondent B: Yes. we offer a large set of courses on eAccessibility. Usually, the same courses that we offer to our clients are taught internally.

There are not much "formal training" in eAccessibility. There is a lack of official degrees on the topic.

In case training courses/material on accessibility would be offered, how would you like to receive/use it (in-house training, external courses, online courses, written material)?

We offer all this sort of training, and the clients choose the option that suits best with their needs. When providing it internally, we prefer in-house training.

Do you need support in technical know-how provision concerning accessibility, e.g. a pool of knowledge, an information service, expert services?

No. We have the expertise inside. However, we contract punctual training externally on very specific topics

Respondent C: Yes

Well equipped with some big issues like diff between browsers. More detailed info.

Respondent D: Most is achieved in-house.

Here are some general principles:

Simple language: Do not confuse engineers with different terms for the same purpose: Accessibility, Universal design, design for all, age resistant design, inclusive design... I have wasted so many hours of my life to explain differences. We decided to use only the term accessibility which is well established and defined by laws and regulation.

Accessibility is one of many requirements for a product design, e.g. a mobile phone underlies about 2500 different requirements. Provide engineers with exactly the information they need preferably in their language (checklists, detailed technical specification)

People with impairment are a non homogenous user group!

Information of consumers, resellers and providers of assistive technologies are required.

Installation and configuration is crucial for accessibility.

Special briefing, training and instruction materials are necessary.

Accessibility is no yes/no decision.

The accessibility of a product is perceived very individually due to age, experience, training or type and degree of impairment.

To assess accessibility with a high accuracy (67,12345%) is of low value, provides no information and therefore waste of money.

Question #10: Realisation of accessibility – tools used – Do you use any guidelines, standards etc to achieve accessibility – More required

Respondent A: ISO standards, WCAG but we don't use them much

No, they are there, just need to use them more

Respondent B: All the W3C standards and guidelines are strictly followed in our Web technology developments. In ICTs beyond the web, other sources of standards and guidelines are followed.

The development frameworks are chosen with the accessibility criteria in mind.

We have established our own internal procedures for producing and testing accessibility products, services, documents, etc. All our products and services are tested by the accessibility department.

Harmonization in standards and guidelines in non-Web technologies

Respondent C: WCAG BITV 508

Yes – some gaps

Respondent D: The most efficient way is to include accessibility in the already existing (company individual) quality process for the whole product development phase. This helps also to record the success and can be used for a self-declaration of conformity (without waste of time and money for third-party assessment). Our processes are based on accessibility standards like ISO TR22411 or 9241-171 or WCAG2.0 ...

Question #11: Continue to establish a culture of Universal Design – How important is accessibility of products in your company – Design for all part of philosophy – "Accessibility" a quality criterion of your mainstream products – Accessibility check part of your quality management process

Respondent A: It's what we do

Yes, in spirit but often ignored in letter

Yes

Sort of. It's implicit but not an actual checklist

Respondent B: We are a technology and consultancy company belonging to a big business corporation. Its mission is twofold:

Implement Inclusion Programmes for people with disabilities: Employment Training and Job Creation

Promote Universal Accessibility of environments, products and services.

Yes. All our technological development and consultancy activities are carried out with accessibility and design for all criteria.

Yes. The accessibility is considered as a quality criteria, thus an added value for our customers.

Yes. All our products and services are tested by the accessibility department.

Respondent C: Very – Very – Yes – Yes

Respondent D: Accessibility is one of the many strategic targets of our company, agreed and supported by the top level management.

But we do not support other concepts like Universal Design or e-inclusion on this level, because they are in principle the same but not covered by regulation.

Question #12: How does your organisation support TT between stakeholders regarding Accessible ICT – How do you cooperate with external partners – Need for more co-operation/co-ordination of TT activities

Respondent A: Via EC projects

Not for us

Respondent B: The cooperation is mainly carried out through:

Collaborative R&D and innovation projects at national and European level focused in the eAccessibility field.

Dissemination activities: Organisation and participation in national and European workshops, expert panels, round tables, etc.

The training initiatives offered to our clients

It is essential. Cooperation projects (like those of FP7, CIP, etc.) are required. Not only for TT among Universities/Technology Centers and commercial organisations, but also to take advantages of the synergies and avoid redundant efforts.

Respondent C: Not too much. Industry is so competitive that sharing of knowledge is difficult

Respondent D: See above. We often observe missing accessibility knowledge or engagement at our customers. There is always the question why they should waste efforts (and money) for addressing an unknown small user group. There is also missing awareness at SMEs. We are currently running an information activity for SMEs at BITKOM.

Question #13: Prepare accessibility for the market – Prepare the market for accessibility – Aware of market demand for accessible products/services – Need for more information

Respondent A: Yes, it is what we intend to do

Not for us, but yes in general

Respondent B: It is our main business area.

Additional info is always welcome

Respondent C: Yes – Yes

Respondent D: We are completely aware of the market demand of accessibility.

But we also have some knowledge on the real sales figures which really do not comply with the always presumed expectations and the willingness of the consumer to buy accessible products.

Some, but not the only reasons are: End users do not have the knowledge, which of the products fits best to their individual accessibility needs. Products are often selected by price.

There is no harmonised view or standard on accessibility in Europe. Each EU country has released it's own (of course best) rules for accessibility.

Question #14: What can policy makers do to practice a policy of accessibility – Action/support to improve TT

Respondent A: More funding of projects that must become commercial products.

Respondent B: The publicly funded projects (whether national or European) are a good measure that should be strengthened. Among them, the more close-to-market programmes (e.g. the CIP programme) are more relevant for TT to the commercial organisations, therefore, special attention should be given to them.

Respondent C: Focus too much on specific sectors, for example public sector. Law makers to consider changing guidelines to laws. For example all intranet/internet must provide accessible tools for all users. Laws too general and not enforced.

Respondent D: In view of the current EU fiscal situation we expect that accessibility is one of the first subjects where cost cuts will take place.

Politicians should support the concept of accessibility first.

An extension to other concepts like e-Inclusion is a nice extension but not reasonable at the current stage.

Highest priority should be given to harmonise accessibility rules and standards across Europe which is beneficial for all: the end user, the manufacturer, and the buyer/ payer/ procurer. this should be achieved even with the danger that not all agree on a optimal but may be suboptimal set of functional accessibility requirements.

8.3.7. Evaluation summary

Having interviewed key mainstream ICT's and a number of Universities, it is clear that there is an ultimate goal to build accessibility into all technology so that it can't be avoided. However, many barriers and gaps exist. 25% of respondents said that accessibility is only one part of their criteria, safety, consumption etc are also rated as highly as accessibility and therefore not treated differently internally but rather on a par.

75% of respondents said that one of the big issues is the rapidly changing technology environment and the lack of ability for older people or persons with disabilities being able to understand the new technologies. Whilst online shopping for example has increased substantially, there is still a fear of risk in these groups to conduct purchasing or banking online. 50% of respondents said that further information should be provided to the general public about accessibility and a national PR programmes launched in all European countries to educate the masses.

75% of respondent said that due to commerciality and given that most users do not actually know what their own accessibility requirements are (general view that most purchasing decisions are made on price alone), internal management teams can often challenge the need to look at smaller user groups (effort/money/time etc). 65% of respondents said that more trials/research should be conducted in user organisations with collaborative links established directly with manufacturing to improve TT. For example, it was suggested that the EC provide funding to service providers with disabilities to conduct internal trials on various products/software and feed back information to their manufacturing partner.

75% of respondents also said that the link between universities and manufacturing could be stronger and that much knowledge transfer can be lost here. 90% felt that given that each country appears to have their own standards, it will always be difficult, for example, most countries have their own software laws – which all software companies must comply with. This can be difficult and costly. 50% of respondents said that they feared costs will be cut given the current fiscal situation. 82% of respondents suggested that if standards and rules were synchronised it would lead to benefits for everyone (buyer/user/manufacturer).

On examination, many felt that the laws are not broad enough (e.g. a lot focused on the public sector only) and tend to be more guidelines as opposed to regulation and therefore not enforced/required to comply. It was felt that politicians need to embrace accessibility first and then look to change the regulations in all EU countries. 25% of respondents suggested more funding of research projects in general. In terms of consumer behaviour, 60% of respondents felt that the continuous change in technology and the lack of understanding of their own requirements is confusing and most will purchase on a basic requirement need – e.g., I need a phone to make and receive calls easily. They will be unaware of the benefits of voice recognition etc and therefore will buy the cheapest option perhaps. Again, it was suggested by many to encourage mainstream ICT's to advertise more of the accessible features of their products to educate users.

40% of respondents employ user groups for testing and feedback and most have some relationship with external experts or organisations.

50% of respondents said that detailed information in certain areas is difficult to find and can restrict progress. For example, the differences between browsers. Whilst much information is available, there is an appetite for more support/information. Sharing of information can at times be a barrier given the competitiveness of the environment. Unfortunately, in many cases profitability comes first and many minority group needs are ignored by larger organisations.

75% of respondents said that in many cases the information received from research centres and universities has not delivered anywhere near ready for market prototypes which may be the cause for the declining link between research and manufacturing organisations.

50% of respondents do not formally measure the success/failure of technology transfer with only 25% of respondents occasionally translating knowledge from research activity.

8.3.8. Recommendations to improve TT in Accessible ICT

End-user needs that are known and respected

Q~1: End-users should better understand their accessibility requirements.

Q~2: End-users should be better informed which available technology or technical products meet their accessibility requirements best.

Q~3: More trials/research should be conducted in user organisations with collaborative links established directly with manufacturing.

Q~4: EC should provide funding to service providers with disabilities to conduct internal trials on various products/software and feed back information to their manufacturing partner.

Awareness – knowledge – skills concerning

Q~5: Assistive ICT is years behind the general ICT, with a tendency of a growing gap.

Q~6: Improve access to detailed information; in certain areas is difficult to find and can restrict progress.

Q~7: So much new technology and continuous change in ICT. Therefore there is no stable knowledge; therefore knowledge on accessibility of ICT needs to be updated frequently; awareness and efficient means for the provision/exchange of knowledge are basic preconditions for this.

Q~8: Accessibility is one of many requirements for a product design, e.g. a mobile phone underlies about 2500 different requirements. Provide engineers with exactly the information they need preferably in their language (checklists, detailed technical specification)

Procedures – tools – methods – environments

Q~9: Be consistent in terminology; do not user different expressions for the same thing/concept.

The technology transfer process

Q~10: Formally monitor/ measure the success/ failure of technology transfer.

Technology transfer networking between stakeholders

Q~11: Industry is so competitive that sharing of knowledge is difficult.

Q~12: The link between universities and manufacturing should be stronger because much knowledge transfer can be lost here.

Q~13: Improve the information transfer from research centres and universities to manufacturing organisations.

Market and market supports

Q~14: Encourage mainstream ICT's to advertise more of the accessible features of their products to educate users.

Q~15: Information of consumers, resellers and providers of assistive technologies are required.

Q~16: Installation and configuration is crucial for accessibility.

Q~17: Special briefing, training and instruction materials are necessary.

Q~18: Provide sufficient information about the market. – Often observe missing accessibility knowledge or engagement at customers. There is always the question why they should waste efforts (and money) for addressing an unknown small user group.

Q~19: Provide consistent and plausible information about the market. – But we also have some knowledge on the real sales figures which really do not comply with the always presumed expectations and the willingness of the consumer to buy accessible products.

Q~20: Train users to use innovative products. – Often users with different disabilities are not trained or are not willing to learn how to use new technology / assistive devices. Other barriers are sometimes the burden (time) of always learning new things without an obvious benefit for the person. – Especially true for elder people.

Policy to support technology transfer

Q~21: Provide more funding of research projects in general.

Q~22: Provide further funding of commercial projects. – Some are more relevant to TT (CIP for example).

Q~23: Harmonization in standards and guidelines, especially in non-Web technologies – There is no harmonised view or standard on accessibility in Europe. Each EU country has released it's own (of course best) rules for accessibility. – Highest priority should be given to harmonise accessibility rules and standards across Europe which is beneficial for all: the end user, the manufacturer, and the buyer/ payer/ procurer. this should be achieved even with the danger that not all agree on a optimal but may be suboptimal set of functional accessibility requirements.

Q~24: Politicians should support the concept of accessibility first.

Q~25: Lobby politicians to get behind accessibility and ultimately synchronise all legislation across Europe to ensure enforcement

8.4. References / Reading

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