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Towards a technology transfer roadmap from the Coordination Action in R&D in Accessible and Assistive ICT (CARDIAC)

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Abstract. This article presents the initial results from the first road-mapping event organised on the theme technology-transfer in the field of assistive and ICT products by the FP7 Coordination Action CARDIAC (Coordination Action in R&D in Accessible and Assistive ICT). The paper will first of all set out the context of technology transfer within the field accessible and assistive ICT products before going on to describe the SDDP (Structured Dialogic Design Process) methodology employed to generate the roadmap. The article will conclude with an initial analysis of the roadmap and some suggestions as to the next steps that need to be taken to enhance technology transfer in this field.

Keywords: Technology transfer, accessible ICT, assistive technology, road-mapping, structured dialogue

In action line F of the Heart study several recommendations related to technology transfer were made. One of them "Establish mechanisms for technology transfer (F14)" was inspired by the lack of information transfer from general industry to the companies, often SMEs, active in assistive technology development. Recommendation F15, "Introduce accompanying measures to ensure the diffusion of new products and services" found its origins in a lack of knowledge about new and innovative products on the market. "Identifying and monitoring technological synergies" (recommendation F17) covers the Heart consortium concerns for an adequate technology transfer between industrial branches. Finally F18, "Promote a multi-disciplinary research and development protocol for implementing needs driven approaches in product development."
Although some of the information exchange aspects are nowadays solved by the internet, other recommendations are still valid. They are covered in this article.

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1. Introduction to technology transfer

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 available to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services.

The market for Accessible and Assistive ICT products and services is complex and presents many challenges for successful technology transfer [15]. 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 in the area of Accessible and Assistive ICT must be whether or not a product reaches the market place and is available to consumers throughout the EU. It is clear that much

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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 the 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. [16].

On the other hand, a number of approaches and solutions are available that support the ICT industry in implementing accessibility into their products and services in various stages of product development, maintenance and service provision. These "solutions" include methodologies, guidelines, knowledge bases and hardware and software components, tools for modelling, simulation or verification, as well as interfaces to already existing external assistive technology.

Besides the application of such "solutions", some industrial companies have established structures and procedures in their organisation that take care of accessibility aspects, be it a part of their product philosophy or just a matter of quality assurance. These can also include cooperation with other organisations from the same technological area, with user-oriented organisations or with assistive technology companies [14].

1.1. Main issues with technology transfer

It has long been accepted that companies and organisations find the technology transfer process difficult to navigate, often citing barriers to successfully placing products in the marketplace. Some of these barriers originate in traditional difficulties encountered across many industries, however particular problematic issues emerge for the Accessible and Assistive ICT market, including the following:

1.1.1. Heterogeneous market

The market for Assistive and Accessible ICT is subject to great debate with people with disabilities representing a disparate and difficult to define market. It is broadly accepted that categorising people with disabilities, let alone categorising their particular and individual needs is a fraught process with many influencing factors from contextual, interpersonal and cultural factors all having a bearing on the problem.

1.1.2. Differing market distribution methods

Across the EU, people with disabilities and the elderly access products designed for their use through many different systems, from statutory provision with highly regulated distribution to free and open economic models where individuals are private purchasers. Often the contexts in which the person is expected to use the technology will have an impact on the method of distribution.

1.1.3. Point of access

One difficulty that often emerges as a result of the issues mentioned in point 2 above is that different customers are often expected to access the same technology from different providers. For some people with disabilities, one technology will be available from providers working in a healthcare context, and the same technology is available from providers working to support those in education or vocational pursuits. This is particularly evident when a country has a statutory distribution system for technology, with very specific providers working in each domain.

1.1.4. Funding

Another issue often brought up over the years has been the cost of technology, and where the burden of cost is assimilated. This is as a result of various factors, including the fact that the primary purchaser is sometimes seen as the State, and therefore typical market rules of economics don't apply. On the other hand, products and services purchased by large organisations (through a call for tender) might profit in the future from the accessibility measures studied currently in the EU mandate 376 on Procurement Rules.

1.1.5. Awareness

Organisations representing the elderly and people with disabilities often report that there is poor provision of information at national level within countries regarding the technologies that may be available and the benefits that can be gained from their use. This issue has been dealt with in a number of ways: however, potential users are often dependent on brokers such as service providers to provide opportunities to interface with vendors, manufacturers or distributors of technology.

2. SDDP methodology

2.1. Introduction to SDDP methodology

The Structured Dialogic Design Process (SDDP) is a methodology that supports *democratic* and *structured*

dialogue among a group of stakeholders. It is especially effective in resolving multiple conflicts of purpose and values, and in generating consensus on organizational and inter-organizational strategy. It is for these reasons that it was selected to generate the roadmaps within the CARDIAC project.

The SDDP methodology is specifically designed to assist non-homogeneous groups to deal with complex issues, in a reasonably limited amount of time. It enables the integration of contributions from individuals with diverse views, backgrounds and perspectives through a process that is structured, inclusive and collaborative. A group of participants, who are knowledgeable and have a stake in a particular situation are engaged in collectively developing a common framework of thinking based on consensus and shared understanding of the problems of the current state of affairs and roadmaps that facilitate solutions in the most economic and efficient manner.

The methodology promotes focused communication among the participants and offers the additional advantage of giving the participants a sense of ownership and commitment towards the outcome.

2.2. Background

The Science of Structured Dialogic Design^{SM} (SDD) is a validated methodology for dialogic design, which integrates knowledge from mixed participants in strategic design settings.

Structured Dialogic Design^{SM} can be seen as a branch of systems sciences with applications in social sciences with its roots in cybernetics, application of systems sciences in social contexts and the science of complex systems that emerged in the early 1970s. Dr John Warfield is credited with the application of the principle of Interpretive Structural Modelling [4] in the analysis of complex socioeconomic systems, which became a major consensus method in the application of SDD. It was however, Dr. Aleco Christakis and his group that are credited for the formulation of the methodology in its present form [6,8,10]. The process is supported by a computer system [3].

During the past decade, there has been an exponential growth in the number of dialogues organized using what is known as the *science of structured dialogic design.* An increasing number of facilitators, workshop organizers, consultants, participants, scientists, and lay people show great interest in learning more about this science.

The Cyprus Neuroscience and Technology Institute has a long history and experience using this methodology in a range of domains, from education to civil conflict and have in the past utilised the process to great effect in two COST Actions (COST 298 and COST 219ter).

2.3. How SDDP works

Figure 1 illustrates the basic phases of this methodology. The "Triggering Question" (TQ) is used in order to constrain the breadth of the dialogue. One-sentence responses to this TQ are articulated by all participants in a round-robin manner and subsequently time is available to explain details about specific contributions and ask for clarifications.

No arguing over content or judgement is allowed at this stage as the intention is to understand each other's points of views. The next phase involves a bottom-up approach towards clustering the ideas according to common attributes. This and the previous process support stakeholders gradually developing a common language, shared understanding of the complex problem and highlights small but sometimes very important distinctions in the meaning of individual contributions. All participants then vote on which observations they consider most important. Usually they are given five coloured dots that they can stick on the observations of their choice, which are posted on the wall. These votes are tallied.

The structuring phase that follows includes only ideas that have received at least 1 vote. With the help of pairs of observations projected on the screen, the participants decide by super majority (2/3 was used in this project) whether achieving observation A (or making progress in resolving the particular problem) would *significantly* help in achieving observation B. The exploration of influences of one idea on another is extremely important because it gradually produces consensus as to the leverage points on which investments would provide the maximum return. The otherwise exhausting task of comparing thousands of pairs is simplified by the transitive logic of supporting software, so that approximately 150 votes do the job in about 4 hours. In this process, the stakeholders are not burdened with trying to keep track of the bigger picture because the software manages the mechanical logic of how their decisions fit together. At the end of this process the stakeholders collectively produce an influence tree that graphically presents the conclusions they have reached. This 'tree' or roadmap reveals the leverage points for applying effective action to work out their complex situation.

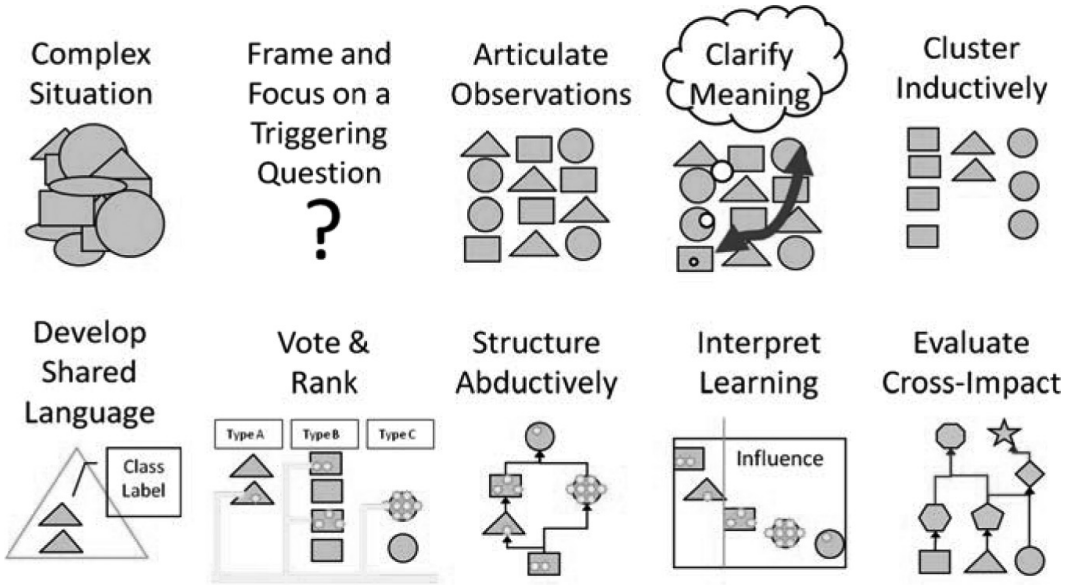

Fig. 1. The SDDP phases.

3. Results from first CARDIAC SDDP on the theme of technology-transfer

The quality of the output of an SDDP event depends heavily on the competence and breadth of knowledge of the people participating in the discussions. The participants were therefore carefully selected amongst the stakeholders identified as being the most relevant to the technology transfer process (see list of participants in acknowledgment section).

Following a two-month consultation with these stakeholders via the CARDIAC Wikispace [1], the following Triggering Question was formulated ahead of the three-day road mapping event: "What mechanisms would ensure successful technology transfer in accessible and assistive ICT product and Services".

The participants were then given the opportunity to draft their responses both ahead of the meeting via the CARDIAC Wikispace and during the first day of the meeting. Overall, eighty-seven responses to the Triggering Question were collected from the twenty participants. After a one and a half day clarification and clustering session, the participants were each given 5 votes. The results of this vote are shown in Table 1. It should be pointed out that there is no significance to be attributed to the numbering of the ideas, which were allocated in the order in which they were registered in the system. The table shows that idea 17 received 6 votes, idea 42 received 5 votes, 5 ideas received 5 votes (1, 49, 70, 73, 27), 7 ideas received 3 votes each (15, 62, 12, 23, 25, 29, 13), 15 ideas received 2 votes and 18 ideas received 1 vote, with 100 votes cast in total (20 participants).

Overall therefore, 47 out of a total of 87 ideas received more than one vote. This result is described scientifically by the parameter of *Spreadthink* or divergence (ST or D respectively), the value of which is in this case 51% of disagreement. According to numerous studies, the average degree of Spreadthink is 40%, where Spreadthink is defined as (V-5)/(N-5) where N is the total number of ideas and V is the number of ideas that received one or more votes. This suggests that the participants did not demonstrate a very high degree of consensus and they might continue to interpret the issues in a different manner, but 51% disagreement is within acceptable boundaries.

The ideas with the most votes were thus democratically selected for the crucial structuring or "linkage" phase of the process. The participants were able to structure 34 ideas (out of the 47 ideas which received votes). All ideas which received 2 or more votes were included, while from rest, the participants chose the ones they felt had the potential to end up in the lower part of the tree. The result of this structuring process, carried out during the meeting and during two remote sessions after the meeting is shown in Fig. 2.

4. Analysis

The 'tree of influences' or roadmap is made up of 7 different levels. Three pairs of ideas are cycled together

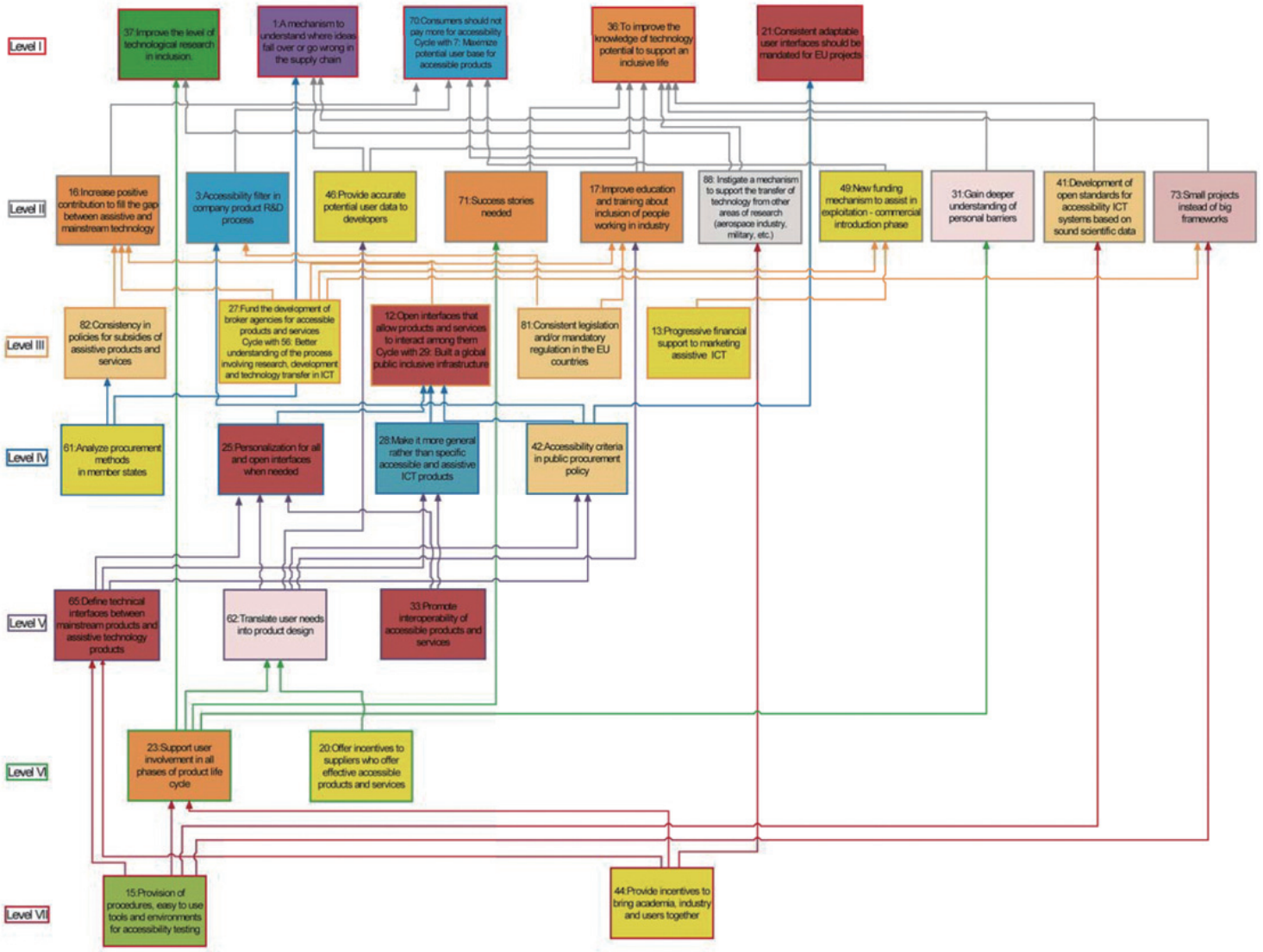

Fig. 2. "Tree of influences" or roadmap where the clusters are represented by different colour.

Table 1
List of ideas that received at least one vote

No.	Idea	Votes
17	Improve education and training about inclusion of people working in industry dealing with mainstream	6
42	Accessibility criteria in public procurement policy	5
1	A mechanism to understand where ideas fall over or go wrong in the supply chain	4
49	New funding mechanism to assist in exploitation - commercial introduction phase	4
70	Consumers should not pay more for accessibility	4
73	Small projects instead of big frameworks	4
27	Fund the development of broker agencies for accessible products	4
15	Provision of procedures, easy to use tools and environments for accessibility testing	3
62	Translate user needs into product design	3
12	Open interfaces that allow products and services to interact among them	3
23	Support user involvement in all phases of product life cycle	3
25	Personalization for all and open interfaces when needed	3
29	Build a global public inclusive infrastructure	3
13	Progressive financial support to marketing assistive ICT	3
28	Make it more general rather than specific accessible and assistive ICT products	2
82	Consistency in policies for subsidies of assistive products and services	2
71	Success stories needed	2
21	Consistent adaptable user interfaces should be mandated for EU projects	2
33	Promote interoperability of accessible products and services	2
36	To improve the knowledge of technology potential to support an inclusive life	2
37	Improve the level of technological research in inclusion	2
7	Maximize potential user base for accessible products	2
65	Define technical interfaces between mainstream products and assistive technology products	2
44	Provide incentives to bring academia, industry and users together	2
46	Provide accurate potential user data to developers	2
20	Offer incentives to suppliers who offer effective accessible products and services	2
61	Analyze procurement methods in member states	2
3	Accessibility filter in company product R&D process	2
56	Better understanding of the process involving research, development and technology transfer in ICT	2
5	Focus on novel and creative designs	1
10	Studies that demonstrate the positive contribution of assistive and accessible ICT	1
11	Realizing proof of concept is not a product or service	1
55	Make basic research researchers aware of the application field of accessibility	1
81	Consistent legislation and/or mandatory regulation in the EU countries	1
53	Specific methodologies and tools for the development of accessible ICT	1
16	Increase positive contribution to fill the gap between assistive and mainstream technology	1
18	Identify and effectively communicate the market potential of assistive ICT products and services	1
50	Understand the market dimension: local versus global	1
19	Separate the three pillars of a cost benefit analysis. Accounting/ economic/ social value	1
48	Improve links with the e-health market	1
22	Support users to demand accessible products and services	1
63	Ensure ICT reliability, robustness and security	1
31	Gain deeper understanding of personal barriers	1
64	Focus on inter connectivity of technology	1
69	Implement UN convention	1
41	Development of open standards for accessibility ICT systems based on sound scientific data	1
67	Actually penalize countries, organizations and companies who don't implement accessibility and use the funds for R&D	1

(70 and 2, 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. It is also interesting to note the location of the various ideas according to the amount of votes received. It is often the case that the ideas that receive the most votes find their way to the top of the roadmap. This is borne out in this case where the seven ideas that received most votes are all located towards the top of the roadmap (levels I-IV). The ideas that received the least votes are more randomly located all over the roadmap.

This can be explained by the fact that the ideas that manage to encapsulate widely-held aspirations, ex-

pressing the ultimate collective aim or vision may well receive the most votes but require other more practical issues to be resolved before they can be achieved.

The more practical ideas, which may or may not have received the most votes, are often located towards the bottom of the roadmap (level IV-VII). These ideas have the greatest degree of influence and the rest of the analysis will therefore concentrate on these ideas. This phenomenon is known as erroneous priorities effect [11].

The collective wisdom of the participants revealed that the following four mechanisms were probably the most influential and that the stakeholders should give these a higher priority:

Level VII: 15: Provision of procedures, easy to use tools and environments for accessibility testing
44: Provide incentives to bring academia, industry and users together

Level VI: 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 tree should be interpreted is that the actions which aim to support these four mechanisms will have the greatest influence in achieving large-scale organisational changes. 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 roadmap 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 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 organisation, 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 organisation 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 Intellectual Property Rights (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 organisation. 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, including initial design. 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 and 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. Often perfectly working technical solutions have not been accepted by the users because of psychological barriers. 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 organisations 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 organisations 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 roadmap indicates that this continues to be a key issue and that there is an ongoing need for measures to support the generation, provision and interdisciplinary 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 they 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 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 licence 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 benefits 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 is proving that they have made their products and/or services more accessible.

The next level in the roadmap that exerts great influence is Level V with 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. Furthermore computer input technology (e.g. on smartphones) is embracing touch screens nowadays, which presents completely different accessibility problems.

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 make 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.

The other two mechanisms in Level V 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.

For reasons of space it is not possible to continue the analysis right up to the top of the roadmap. The analysis will therefore conclude with a discussion relating to two of the mechanisms on Level IV, mechanism 28 and 42.

Mechanism 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 behind this mechanism 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.

Another possibility would be to incorporate assistive ICT as part of the growing sector of E-healthcare services and technology. A third possibility would be to integrate it as part of developing approach of personalized medicine/ personalized services. Current trends in medicine, science and even design are moving towards the concept of tailoring to specific needs of special populations. This includes children and adolescents, women (e.g. pregnant women), people with extraordinary ergonomics, and naturally elderly people and people with disabilities would fall within these subgroups.

Mechanism 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 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 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 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.

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 might be 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 in the US as well as Mandate 376 in the EU [18] attempt to do this, but we need a better way of specifying the 'accessibility criteria'. Once this is done, there is every likelihood that procurement policy will significantly influence the technology transfer process.

5. Conclusions

The issue of technology transfer in the field of accessible and assistive ICT product and services is a very

complex issue involving a wide range of stakeholders from many different areas. The results show that the SDDP methodology is well suited to this kind of a multi facet problem with interconnected issues where it can be a useful tool to harness the collective wisdom of a wide range of stakeholders and bring new perspectives and approaches to a given problem. Of course the methodology itself will only generate the raw data in the form of an "Influence Tree" or roadmap and further input and analysis is needed from the participants to determine the way forward. The example described in this article has shown the possibilities of using such a tool with a complex triggering question and the initial analysis can form a basis for the continuing discussion of how to improve technology transfer in the area of accessible and assistive ICT products and services.

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