# Preliminary Findings from Experts' Opinions on the Future of e-Accessibility

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**Abstract.** Subject of our work is to explore and analyze the referred relationships between the emerging ICT landscape in the European societal and economic context, and the development and provision of e-Accessibility, within a perspective of 10 years. Some core areas of concern we deal with are represented by the following questions: Which are the trends that may affect the future of e-Accessibility (incorporating web-accessibility, design for all and assistive technology) in Europe and internationally? What may be the impact of those trends on the course of e-Accessibility? What are the dynamics of e-Accessibility actors in Europe and globally? Where is the industry heading to?

**Keywords:** e-Accessibility, metaphors, interaction environments, e-Accessibility standards

## 1    Introduction

This paper reports work carried as part of the study on e-Accessibility2020 ("Study on Implications from Future ICT Trends on Assistive Technology and Accessibility", SMART 2010/0077) which aims to provide the European Commission with recommendations on future research policy, especially regarding Framework Programme 8 (ICT & FET) and the next Competitiveness & Innovation Programme (CIP).

Also, the study will make suggestions on relevant standardisation issues and on EC policy activities for the wider mainstreaming and adoption of e-Accessibility. To do so the study team will elaborate and validate specific use and technology-scenarios for 2020.

These scenarios will result from vigorous interaction with e-Accessibility-related stakeholders and experts, which will involve among other the identification and assessment of 'Drivers of Change' affecting the course of e-Accessibility (i.e. key-trends, micro-trends and weak-signals).

The study approach adopts a variety of methodologies, tools and activities and it is presented at www.e-accessibility2020.eu together with news, e-surveys and eventually the study results.

The study is conducted by ALTEC Software Development, Greece in partnership with CKA, Belgium for the European Commission, DG Information Society & Media, Unit 'ICT for Inclusion'.

**e-Accessibility** aims at ensuring that people with disabilities and elderly people access ICTs on an equal basis with others. People with disabilities in Europe continue to be confronted with many barriers to usage of the everyday ICT products and services that are now essential elements of social and economic life. Subject of our study is to explore and analyse the referred relationships between the *emerging ICT landscape* in the European societal and economic context, and the *development and provision of e-Accessibility*, within a perspective of *10 years*.

Some questions we deal within our study are:

- Which are the trends that may affect the future of e-Accessibility (incorporating web-accessibility, design for all and assistive technology) in Europe and internationally?
- What may be the impact of those trends on the course of e-Accessibility?
- What visible interdependences exist between various trends affecting the future of e-Accessibility?
- What are the dynamics of e-Accessibility actors in Europe and globally? Where is the industry heading to?
- Are there different 'schools of thought' among e-Accessibility stakeholders/ experts? Do these schools follow the typical categorisation? (e.g. industry versus academy)
- What can be the alternative futures for e-Accessibility?
- How can the EC and other e-Accessibility stakeholders influence the future of e-Accessibility?
- What relevant research priorities and policy measures are realistic for 2020?

## 2 Subject and methodology of the study

The subject of the study is broken down into 3 objectives:

 *i. Validated analysis of the relationships between the emerging ICT landscape, the societal and economic context and the development and provision of assistive technologies (AT) and e-Accessibility, building on a sound understanding of relevant trends and challenges.*

This is achieved by identifying the 'Drivers of Change' (i.e. key-trends, micro-trends and weak-signals) that (may) affect the evolution/ future of e-Accessibility and AT. Such drivers are partly already defined within the 'abundance' of relevant work recently carried out, while another part are identified through creative work under the proposed methodology. Indicators that characterise the 'Drivers of Change' are collected, calculated or estimated to help assessing the impact that the latter may have on e-Accessibility and AT. This assessment is made with the active involvement of representatives of relevant stakeholder as well as expert that also help to validate the

results. Relationships between the different categories of trends (i.e. ICT, societal, technology/market: ISTeM) are obtained by grouping the results of the impact assessment per category of trend or by comparing the impact of different drivers. Furthermore, dynamics on the evolution of e-Accessibility and AT networks in research are examined and assessed through a Social Network Analysis (SNA). *Value Chain Insights* (VCI), a methodology specially designed for the needs of opur research and explained later in this paper, also has an important contribution on the above. A thorough data/info gathering, organisation and initial analysis process precedes all the above.

  *ii.  To elaborate and discuss a series of hypothetical scenarios on the future evolution of AT and e-Accessibility*

The results of the impact assessment of the 'Drivers of Change' and of the SNA provide the input for the elaboration of the Use-Scenarios for e-Accessibility 2020. The study team and group(s) of experts/stakeholders work in parallel to form 10 draft use-scenarios according to common guidelines and templates, while the study team is assisted by a specialised software application. The top 4 scenarios (after an evaluation of the draft 10) are selected and further analysed. Then Technology-Scenarios are developed to 'show' the alternative technology paths that e-Accessibility and AT should follow to fulfil the 4 Use-Scenarios. These scenarios are exposed to the study stakeholders and are further discussed during the 2nd workshop.

  *iii.  To provide validated recommendations for research priorities and policy measures that are usable at European level*

Study recommendations will include: (a) Suggestions for specific and more general research priorities on the development of technologies, applications and solutions that may have a significant and positive effect on meeting future user needs. (b) Recommendations for soft-actions in relation to networking and coordination of research, standardisation and policy efforts and related actors at European, international and national level. (c) Suggestions for policy initiatives aiming at the further penetration – diffusion of e-Accessibility and AT (particularly in the public administration). For instance, recommendations on policy measures that may 'boost' specific trends having a significant and positive impact on e-Accessibility. (d) Other recommendations concerning the role and the evolution of e-Accessibility and AT in Europe, etc.

The methodology we follow in our work is divided into 3 phases:

  **(a)** The **Groundwork phase**, where the proposed methodology is further specified and refined, while data/info are gathered, organised and initially analysed in such a way so as to facilitate search, retrieval and use in the following phases.
  **(b)** The **Divergent Phase** introduces the core creative activities of the study aiming to assess key trends and identify & assess micro-trends and weak-signals of future e-Accessibility developments. Initial scenarios are roughly drafted.
  **(c)** The **Convergent Phase** places in order the outcome of the Divergent phase, involves a more structured and consolidated approach towards scenario building, validation and final recommendations and conclusions.
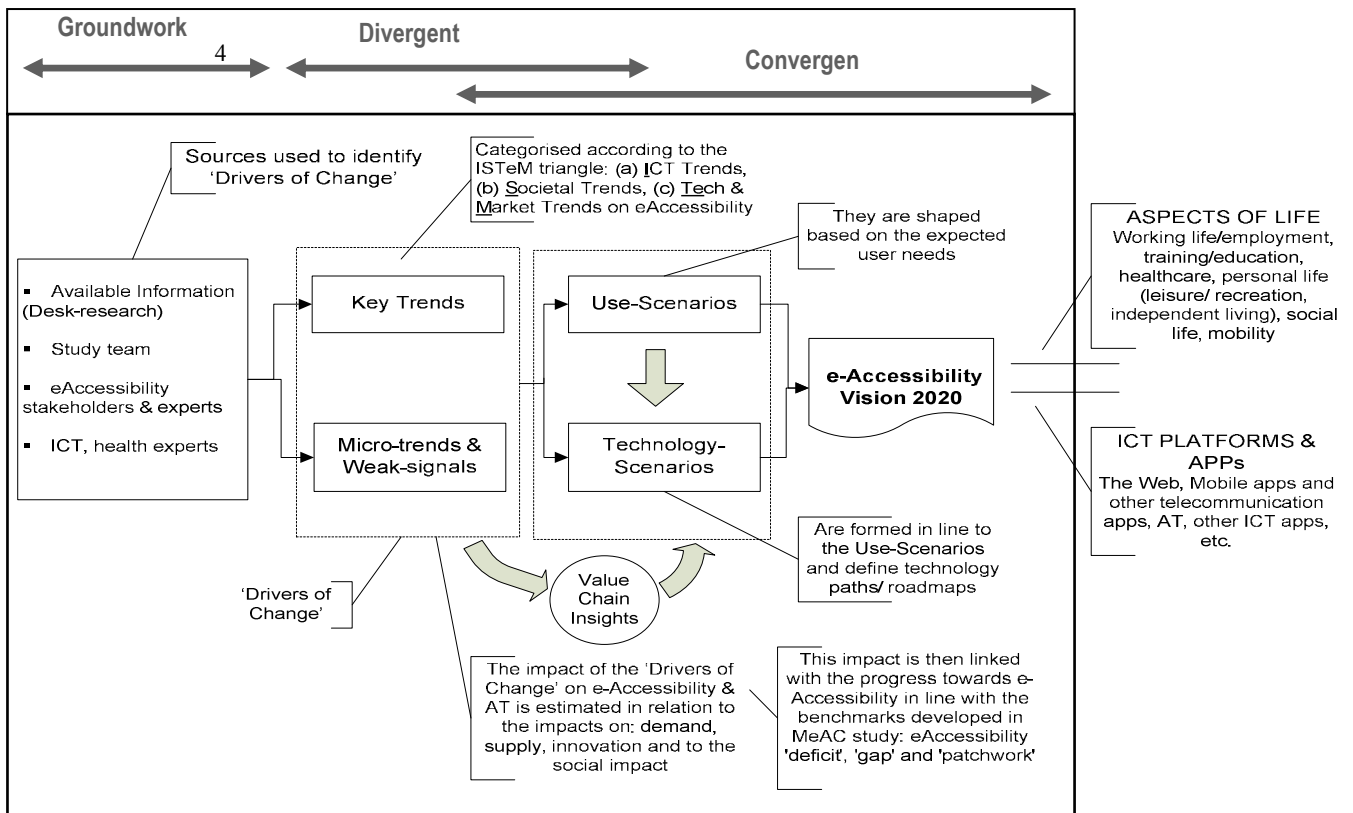
The Divergent phase includes all the 'discovery' work, while the Convergent phase focuses on synthesis and validation. The following diagram depicts the 3 phases of the adopted methodology.

**Figure 1:** Methodology for the adopted work approach

## 3 Current status of the study

Currently the study is in the Groundwork phase where it utilises a variety of research tools to identify key-trends, micro-trends and weak signals that are related to accessibility of ICT. The research tools used in this groundwork phase are the following

**Desk research:** The study team gathers relevant data from research projects in the form of research papers in conferences and journals, deliverables and reports available from EU RTD projects. The resources gathered are organised and categorised in a data repository.

**Interviews:** The study team selected 46 RTD projects from a corpus of 140 RTD projects. The selection was made based on the projects relevance to accessibility of ICT. Apart from projects tightly connected to eAccessibility issues the study team also selected a number of projects relevant to technologies that could possibly help the accessibility of ICT, such as sensor technologies, brain-computer interfaces, multimodal interfaces etc. Following the selection we contacted members of selected members and requested a short interview about their opinions on the future of accessibility of ICT and their specific domain wherever applicable.

**Questionnaire:** A questionnaire is built to investigate stakeholders' opinion on accessibility of ICT and the possible impact of specific policies and technologies in that direction. The questionnaire will be sent to users, experts and a variety of stakeholders both on the research and on industry domain. The results of the questionnaire will be analysed quantitative and qualitative so that the study team will identify key or micro trends in technologies and policies about eAccessibility.

In this paper we are focusing on the on-going research based on interviews with experts thus it is necessary to explain our approach in the analysis of experts opinion before presenting some preliminary results from our interviews so far. The analysis on experts' opinion will also take under account the results from the questionnaires and tie them with the findings from the interviews under a common umbrella.

### 3.1    Advanced analysis on experts opinion

Since experts play a major role in the study, we analyze and attempt to uncover hidden groups (based on their quantitative responses on expected impact and demographic data) that go beyond the obvious categorizations (such as expertise, or sector). It is valuable to see whether the thinking of experts follows such patterns that (i) constitute significant grouping elements (e.g. positivists, technology enthusiasts, risk averters, scepticists) and (ii) which elements are dominant in this shaping.

The inclusion of basic categorization variables in this analysis and the testing of whether these variables play a role in the shaping of groups, might also be useful in busting the hypothesis that such variables are significant (e.g. an academic Vs an industry expert). Ultimately the analysis and specification of these expert's groups might play an important role in understanding and decrypting expert opinion (provided that meaningful clusters occur in our dataset). The resulting groups are data-driven, which means that the actual questions they answered define the categorization. The interpretation of the meaning of groups (cluster centroids) is a non-standardized procedure and will be assessed by the study team during the cluster analysis, and will be evaluated accordingly.

Complementary to the above, we want to test whether these experts (who represent a balanced part of the e-Accessibility value chain) share grouped opinions towards their regards/beliefs of the innovation process. Different attitudes towards innovation/change could mean different level/reach of impact. Our hypothesis that the Value Chain grouping (grouping actors by their position on the value chain) does not correlate with their Innovation/Change attitude could mean that there are heterogenous groups of actors that think differently with regards to innovation (followers, imitators, innovators and so on). We believe that i) such groups will include actors from different parts of the value chain, and ii) these groups have different needs and perhaps more importantly iii) they will catalyze impact arising from key trends accordingly. Insights from this analysis will give **first-time evidence** on what we need to look for before addressing policies to e-Accessibility actors.

A similar analysis to the above has been successfully tested/ implemented in combination with SNA in the study "Social Network Analysis in ePractice" [3].

Associations in experts thinking

Experts are expected to give their opinions and estimations over a large number of trends and variables (e.g. growth, impact severity, impact potential). Instead of (or

complementary to) asking directly for associations among trends, we will employ a data-mining method to check for preliminary associations among the answers. A set of useful and strong association rules will be mined from the experts' responses to check for hints of associations among trends (e.g. 80% of experts that predict low impact of the active ageing indicated a low importance of socioeconomic benefits). These associations are well hidden within the datasets and need to be data-mined with association-rules algorithms (Breadth-First Search (BFS) & counting occurrences Apriori algorithm).

These rules involve all possible Trend2Trend relationships and include searching for complex patterns among answers. The analysis will be performed with the Tanagra O/S package. Cleaning and constituting the table of useful associations will be done by enforcing strict confidence level and face validity checks (rules have to make sense). It should be mentioned beforehand that such rules do not constitute statistical significance, but should be viewed as insights that will help us identify and understand hidden relationships among complex variables.

These preliminary findings will be thoroughly analyzed in collaboration with experts to check whether the identified links do exist, to what extent, and what their impact is before **feeding** the scenario building process.

A major benefit that VCI will have on the recommendations stage is that it will allow us to suggest **policy-related measures tailored to** specific groups of experts, while at the same time VCI will reveal **smart strategies** towards the realisation of policy objectives. For instance, by knowing hidden relationships between trends/ drivers, decision makers can direct available resources towards a limited number of drivers (the change on these drivers however, will indirectly affect all other drivers with which they are connected).

To conclude we illustrate the Value Chain Insights in relation to the identification and impact assessment of the 'Drivers of Change' (preceding step) and the scenario-building and recommendations/conclusions (following step) in the diagram below:

## 4    Some preliminary findings

Below we present some of our first preliminary findings that have been collected as part of our interviews with experts. These findings are not exhaustive or conclusive but they can trigger a discussion and thus help drive the innovation process. For the extraction process of the findings below we would like to express our thanks to Assistant Professor Dr.Yeliz Yesilada of Middle East Technical University – Northern Cyprus Campus and Dr Simon Harper of the School of Computer Science, University of Manchester, U.K.:

1. It is difficult to define accessibility same way as it is difficult to define disability. Currently when we talk about disability we rather mean cases of people being disabled by a device: a blind user not being able to use a tablet PC or a touchscreen. This is wrong as in certain circumstances we are all situationally disabled.
2. Accessibility for all people and to all devices and applications is a dream or a utopia which may become a chimera for the industry in terms of unaffordable costs. How can the owner of a small hotel in Antalya of Turkey or in Serifos of

Greece be able to offer fully a accessible Web site? There is lack of knowhow and expertise in designing accessible interfaces. The last mile of accessibility should not be satisfied by the leaders who set the game and produce the infrastructures of all the previous miles.

3. How can the entirety of Web sites become accessible? It is out of any logical process to expect all people who design Web pages to become aware or experts in the adoption of accessibility guidelines. It is only the leaders of the ICT markets who can change the rules of the game and automate accessibility. Because unfortunately accessibility is still a manual process that in certain special cases and fields has been semi-automated.

4. As already mentioned, accessibility is currently approached with respect to disability. In the future this is expected to change: a user of a World of Warcraft similar game that uses currently his or her mouse device to play the game, in the future will need a haptic e.g. glove device or Kinect to access the game in its newer versions. So a user with a mouse device only is not any more able to access the game or at least make use of its full range of functionality and experience.

5. In a ten years horizon, accessibility will be related more with flexibility plus personalisation plus adaptation to the individual needs of a person.

6. Though inclusion is more general, there is certainly an overlap between the two terms (i.e. accessibility and inclusion): people who are not having access to knowledge and information because they lack the money or the technology means, they are actually excluded from the use of this technology – for them this technology is simply not there as long as they can not enjoy any benefit out of it.

7. Accessibility is primarily not a technical or technological issue only. The socio-economic aspect of accessibility should be given equal significance. So to play with the words, one can discriminate between
   - accessible accessibility and inaccessible one: a blind user who is unable to pay for a certain device adaptor to make his or her IPAD accessible to him or her pays the cost of inaccessible accessibility;
   - inclusive accessibility and non-inclusive one: a blind user from Nigeria who is unable to use an ATM machine in Greece because the only supported languages are Greek, English and Albanian faces a case of non-inclusive accessibility (we assume that blind people who speak Greek, English or Albanian are able to use the ATM).

8. The divergence of devices means there is a possibility of convergence of devices and access technologies. With many different devices being created the gulf between these and access technology does not seem so great, or as polarised as it used to: desktop on one side and AT on the other.

9. Mainstreaming of accessibility will remain a dream: there will be always designers of new systems and applications who will come up with ideas for new devices (or applications) that require all physical capabilities for controlling the device (or the application).

10. Mainstreaming of accessibility technology under the guise of extreme adaptation, extreme customisation, or extreme personalisation or termed as edge cases of personalisation, customisation, or adaptation may well have traction as these

terms have business cases in the form of the flexibility required for delivery on disjoint personal consumer devices such as iPhone and Android platforms.

11. Accessibility means Flexibility – flexibility has a business case – economics may in the end provide the necessary impetus to make accessible software; we have just been waiting for the right disjoint set of mainstream consumer devices to encourage this flexibility.

12. One cannot hinder the evolution and the progress in the ICT field by imposing penalties to those who don't follow certain accessibility guidelines; but we won't have if we use flexibility as the reason for making software adaptable and therefore amenable to assistive technology.

13. The socially responsible stance would be that the market itself and the customers who constitute the markets favour accessible products and penalise non-accessible ones. This stance is too naïve to think that it will ever happen. However, self interest in that flexible products work on anything anywhere means that flexibility is a 'first class citizen' of the distributed devices world; and by implication so is accessibility.

14. Guidelines and standards are a very useful tool in the hands of designers and developers of new products, however there is a growing need for them to become even more specific so that the evaluation of a product's accessibility will become even more objective.

15. No matter how strict of definite guidelines and standards for accessibility become there will still be a need to involve users in the design process and accessibility evaluation of products. As the technologies are evolving so are the users' needs thus the community should always involve them in the proper stages of the design process.

16. Ageing will play a significant role in bringing even more industry in thinking about accessibility. More and more aged people need assistive technology solutions for their everyday life. In addition, there is a societal trend for people to stay in work for even longer periods and since many jobs are using ICT it generates the need for solutions to their problems. An interesting viewpoint of the ageing factor is that designers of todays products are also going to need assistive technology solutions in the future so there might be an even better understanding from the industry.

17. Context – aware devices and applications which are starting to appear as a trend can play a significant role in mainstreaming accessibility solutions. A phone that realizes you are driving when you plug it in your car power and automatically activates a voice dialog interface can also be used similarly by a blind user.

## 5    Conclusions

Markets don't operate in their own; markets don't exist in vacuo; it is the people that make markets respond to needs of the society; and it is the society at large that adapts the markets to the people's needs and wants.

It is a pressing need to find cooperative ways to address our unexplored potential: our schools need visions and the means to realize them; our industries need strategies and the resources to make them work and leave a positive impact on the economies;

our governments and our institutions need to redefine their reason of existence and change paradigms of seeing the world and their role within the society.

Accessibility has been regarded as a measure of the extent to which a product or service can be used by a person with a disability as effectively as it can be used by a person without that disability [4].

Especially e-Accessibility aims at ensuring that "people with disabilities and elderly people access ICTs on an equal basis with others. This includes removing the barriers encountered when trying to access and use ICT products, services and applications". E-Accessibility incorporates all three of web-accessibility, design for all and assistive technology [1].

As such, e-Accessibility is considered a crucial component of eInclusion and one that will become even more important as the European population ages. In fact, improvement of the accessibility of ICT goods can be beneficial to everyone, by making ICTs more usable as well as by facilitating their usage in a wide variety of situations (e.g. hands-free usage, in noisy or poor lighting environments, etc.) [2].

In the scope of this paper aimed to shed light on a set of issues related with the definition of e-Accessibility and how this could help the process for companies, organisations as well as individuals to accept it as a mainstream good that improves life conditions *for all*.

In the past the borders between able-bodied and disabled persons were rigid and impenetrable. Information and Communication Technologies in their origins escalated the situation and instead of helping close the gap, they incrementally opened it unbearably: a blind person would definitely not have access to computerized information while a motor impaired person would definitely be unable to operate a keyboard or a mouse device.

The first attempts were made – as in all cases throughout the human history of inventions – on a voluntary and apospasmatic basis: an IT techie with some relative or friend facing a disability adapted a mouse device or constructed a new one to help facilitate access to him or her. A visually impaired or blind person would make use of some low quality speech synthesis functionality of old computers. This era started of course with the introduction of the personal computer and at some point there was a critical mass of needs and demands from the population's side to support supply from the industry side. Industry in this case meant both the mainstream industry of ICT and the specialized Assistive Technology and accessibility industry that was created.

There have always been channels of interaction between these two industries that helped both to mutually benefit from knowhow, inventions and the shaping of a broadening market.

However, and in contrast with the mainstream markets of ICT products and services where marketing responds more and more to unexpressed needs of the people with novel concepts and types of offerings, the market of accessible products and services has always lagging behind the actual needs of the people affected.

To reverse this situation we need to make a brave confession: the nucleus of our ideas did not take into account the needs of a blind person; the centre of gravity of our research efforts put emphasis and focus to the average able-bodies user. A big mistake that we all of us shall continue to pay till the situation reverses. Which will happen only, if our mentality and attitude towards accessibility change.

The current buyers of consumer electronic products and services who are expected to live for many years in a fast-aging world will be partly blind, partly deaf, partly motor-impaired and partly dysfunctional in cognitive, language and speech-related processes.

So to whom exactly will the ICT industry continue to sell its products?

In a fair and just world, everything should be made accessible to serve the potential needs of even one customer of an ICT product or a buyer of a ICT service. However, all of us know that life is not fair and from an economic point of view it would be unbearable such a case. But what about the case of an incrementally growing population to whom all the currently available interaction means, access techniques and technologies are incapable to support their most basic access needs?

Though we have been living with it for years, we have systematically deluded ourselves of the very nature of accessibility: it does not affect only the disabled; it affects all of us same much for the present moment as for the future.

## ACKNOWLEDGMENTS

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