Inger Lise Skog Hansen (ed.)

ICT and employment
Actors involved in innovation, production, distribution and implementation of assistive ICT in Norway, Denmark, the Netherlands and United Kingdom

Fafo

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Part of the project ICT, disability and employment

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Foreword

Disability policies have shifted focus from economic compensation and medical oversight to a focus on equal rights and full participation in society, including increasing the labor force participation of qualified persons with disabilities. The aim of the project *ICT, disability and employment*, funded by the Norwegian Research Council, is to understand how the development of the new ICT-technology can be utilized in ways that increase disabled peoples' employment prospects. The project's fundamental assumption is an optimistic one: the new technology generates increased possibilities for labour force participation also for persons with severe disabilities.

In this collection of papers we present an empirical study of the innovation / diffusion system for accessibility to ICT for disabled people, with a specific focus on labour market participation. The articles provide an overview of the actors involved in the diffusion system and the relation between them in the United Kingdom, the Netherlands, Norway and Denmark. The data sources are primarily interviews with stakeholders and selected experts in the field, in addition to document studies. In addition there has been conducted a limited technology study in each country, focusing on the diffusion process of Braille displays in each of the involved countries. The forthcoming report from this study will complement the findings presented in this working paper.

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Tone Fløtten, Project co-ordinator

Introduction

By Inger Lise Skog Hansen, Fafo

This working paper addresses the architecture of the diffusion system of ICT to disabled people for the purpose of labour market participation in Norway, Denmark, the Netherlands and United Kingdom. By "architecture of diffusion system" we mean the parties and actors involved in innovation, production, distribution and implementation of ICT for disabled people, including both general ICT and assistive ICT aid.

The working paper is part of the project *ICT, disability and employment*. In the project we study the importance of new information technology as a means to increase employment rates among disabled people. The fundamental assumption of the project is thus an optimistic one: the new technology generates increased possibilities of labour market participation also for persons with severe impairments. However we believe that the potential of the new technology is not fully utilized. Our intention with studying the organization of the so-called innovation/diffusion system is to find out how these systems work to provide disabled people access to necessary ICT in working life. Do different ways of organizing access to ICT for disabled people manage to stimulate innovation of new products and solutions, and do they manage to match the availability of ICT products/solutions with the actual needs experienced in the labour market? A fundamental question is whether different ways of organizing these systems and the different ways they function in the countries compared in this report, influence access to ICT and assistive aid at work places.

In the project there are established a consortium of international partners with researchers from the Institute for Employment Studies in the United Kingdom, AStri Research and Consultant Group in the Netherlands and SFI, The Danish National Centre for Social Research in Denmark. The Norwegian team consists of researchers from the Work Research Institute and Fafo Institute for Labour and Social Research. The papers in this publication are written by researchers from these institutes.

The employment rate of disabled people does not differ radically between the involved countries in this project, except for Denmark. In Norway approximately 45 per cent of disabled people in working age are employed, the rate is 48 % in the Netherlands, 49 per cent in United Kingdom, while it is 55 per cent in Denmark[1] (Hansen 2007:12).

The countries of study are chosen partly because they represent different welfare regimes. Norway and Denmark represent what Esping-Andersen labels as a Social democratic or universal welfare regime. The United Kingdom is the European country closest to a liberal welfare regime, while the Netherlands is a more Conservative welfare regime, but at the same time harder to define, and often placed in the middle between a Social democ-

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[1] These numbers are from the policy study and a table overview of the situation in the involved countries. It was not possible to get directly comparable numbers from all the countries. The Norwegian number is from Labour Force Survey (LFS) in 2007, the Dutch and UK number from LFS 2003, while the Danish is from SFI-survey 2006 (Hansen 2007:11).

ratic and a Conservative welfare regime (Esping-Andersen 1990). These welfare regimes vary in the responsibility they place on parties like the state, the market and the civil society in securing the welfare of the citizens. We assume that these differences will also influence the manner in which these countries relate to accessibility to ICT for disabled people in working life.

In addition to differences in welfare policy, there are also legislative differences between the countries. All countries have some kind of legal protection against discrimination in working life, but the United Kingdom stands out as the only country with comprehensive anti-discrimination legislation, with the Disability Discrimination Act which was introduced in 1995. This act provides disabled workers with legal protection against discrimination and also makes employers responsible for reasonable adjustments in the workplace.

All countries in this study have experienced an intensified workfare policy the last years. Nonetheless, differences in means and approaches make it interesting to compare countries. The Netherlands has since the mid 1990s given the employers an increasing responsibility for follow up and financing of sickness leave, for retention, rehabilitation and income security of disabled employees. In addition there have been different financial incitements to stimulate employers to recruit disabled employees. Denmark, like the Netherlands, increased the focus on employers' responsibility for labour market policy concerning disabled people. The Danish approach uses regulations reluctantly. Instead of regulating the responsibility of employers Denmark has campaigned for stimulating the enterprises' social responsibility for reducing marginalization in the labour market. This approach has been based on agreements between the social partners, similar to the three-party agreement in Norway on Inclusive Working Life[2]. In addition Denmark has had a large structural reform giving more responsibility to local Jobcentres to follow up disabled persons as well as for initiatives at regional and national levels to provide the Jobcentres with information and competence. The Norwegian policy has traditionally been very supply side focused, concentrating on individual measures towards disabled jobseekers. During the last years there has been a shift towards paying more attention to how the enterprises and employers could be stimulated to employ disabled people, but not to the same degree as in Denmark.

The project consists of five different modules. In module 1 we focused on policy for ICT, disability and employment in the four countries. The results from this study are published in a joint collection of articles from the four countries (Fossestøl 2007).

This working paper is the result of module 2 where the aim was to study the architecture of the diffusion system. In module 3 we are conducting a limited technology study – looking closer at the history of innovation and diffusion of one specific assistive ICT tool in the four countries – the Braille display. In addition the partners in the involved countries will conduct a workplace study. Modules 4 and 5 are limited to Norway and consist of a more extensive workplace study and a gathering of a forum for innovation bringing together actors in the diffusion system.

In the following we present papers from the four countries involved in the project on the architecture of the system of diffusion of ICT to employees with disabilities. The ob-

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[2] Three party agreement on Inclusive Working Life between the Government, The Employers and The Labour Union, signed for the first time in 2001.

jective of the study in each country has been to gather information about each one of the actors involved in development, production, diffusion and implementation. The papers from Denmark, the Netherlands and United Kingdom are concentrated on visual impairments as a case study. This decision was made after several discussions among the participants of the team of researchers uncovered the fact that the "systems" in some of the countries are much less organized than the Norwegian system, and that trying to cover the diffusion system of ICT for the whole diversity of disabled people would be a too comprehensive task. Concentrating on visual impairments is constructive because persons with visual impairments most often are dependent on assistive ICT to utilize general ICT. Visually impaired persons will work well as a test case for universal design in this area. A masters thesis written within the project concludes that persons with visual impairments meet several barriers in working life related to ICT, such as access to general ICT and compatibility between assistive ICT aid and general ICT programs and hardware used at the workplace (Fjeldvik 2007). Using visually impaired employees as a case study will in all likelihood yield results and data concerning organizational problems within the diffusion system that can be generalized to other impairment groups as well.

The following papers from the national case studies must be considered as "works in progress". In some of the countries it has been hard to gather sufficient information on all sections of the study. The limited technology study that is to be conducted as a follow up will provide more information. In this introduction we will not give a comprehensive comparison of the systems in the involved countries, but highlight the main findings.

Before proceeding to the concrete findings a short summary of the results from module 1 (the policy study) are presented. This can be useful since module 2 in many ways builds on the results from module 1 and refers to findings in the policy study.

Summary of module 1

In his discussion of ICT policy, disability and employment based on the papers from module 1 Fossestøl (2007) argues that if the integrating potential of ICT is to be utilized to enable disabled people's participation in working life, a social ICT policy is needed. For most ICT products the link between technical solutions and individual needs occurs effectively and simply in the market place. In the field of disability, ICT and employment, several circumstances result in a kind of market failure, a situation where the market in itself is not sufficient to make sure that the potential of ICT is fully utilized for a more inclusive working life. Fossestøl mentions five such circumstances: 1) rapidly changing technology with compatibility and accessibility problems – lack of standardization and universal design, 2) expensive assistive aid to a limited market, 3) development, testing, training and adaption of the technology for each employee to exploit the potential of the technology, 4) employers knowledge of ICT tools, and the practices concerning implementation of assistive ICT aid at workplaces, 5) digital competence.

The technology itself does not necessarily possess an integrating function. Fossestøl argues that the five mentioned circumstances represent challenges to a social ICT policy, concerning for example standards and design, funding of research, development, diffusion and adaption of technology etc. In the presentation of the policy study we argue for a social ICT policy which includes regulatory as well as redistributive measures to secure ac-

cess to ICT for disabled people in working life and utilization of the integrative potential of the technology.

The papers in module 1 showed that the compared countries in varying degree have an ICT policy. In all countries there is to some degree an ICT policy concentrated on economic dimensions, but a social ICT policy is not as visible in all the countries.

Accessibility to ICT for disabled people and digital inclusion is becoming an issue in all countries, but this concern is more articulated in the Scandinavian countries than in the Netherlands and the United Kingdom. National initiatives for accessible ICT are often reduced to a question of web accessibility. All the governments have national targets to make public websites accessible, with guidelines on accessibility.

Denmark and Norway seem to be the only countries at the moment with a national ICT policy on universal design, and Norway is the only country with an action plan for universal design.

The United Kingdom has the most comprehensive anti-discrimination act of the involved countries, but this act only to a very limited degree addresses issues related to universal design and accessibility to ICT. After the policy study was conducted an anti-discrimination of disabled people act has passed in the Norwegian Parliament and will take effect from 2009. This act includes a demand that all new general ICT directed towards the public should include universal design by 2011. This does not necessarily assure larger accessibility to ICT at workplaces. Universal design of ICT in working life is not covered in the new law and in this area there is no further protection than what was earlier covered in the Norwegian Work Environmental Act on reasonable adjustments. The paragraph on reasonable adjustments is moved from the Work Environmental Act to the new Discrimination and Accessibility Law. As seen in the policy study, this act provides protection against discrimination and places responsibility on employers for reasonable adjustments of workplaces, as does the Disability Discrimination Act in the United Kingdom.

The policy study showed that the Scandinavian countries have a more rights-based system for access to assistive ICT in working life than the other countries. Disabled people with a lasting impairment (more than two years) have a legal right to necessary assistive technology, in working life and daily life. In both the Netherlands and the United Kingdom there is no explicit official legal right to assistive technology in working life. At the same time there are regulations concerning reasonable adjustments at work places, as well as laws on occupational health and governmental programs that secure employees access to assistive aid if needed. In both the Netherlands and United Kingdom the policy is to a larger degree based on private actors and in the United Kingdom in particular on the involvement of NGOs and charities (see Fossestøl 2007).

The architecture of the national diffusion systems

As mentioned earlier, the partners decided to concentrate their study on persons with visual impairments. This limitation was especially important in the Netherlands and the United Kingdom where the actors involved in providing ICT-aids vary according to the type of impairment in question.

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Definition of concepts

Several of the concepts used in this study need clarification. One of them is the concept "diffusion system". The term diffusion system is employed to describe the whole system of innovation, production, distribution and implementation of both general and assistive ICT for disabled people in working life. Sometimes this system is also labelled the diffusion / innovation system. This term relates to the fact that the aim of the study is to obtain a better understanding of how the different systems function in relation to communicating the needs of disabled people at the workplaces to innovations milieus and producers, and how the system works in matching the needs of the users with available services and products. What we here label a "System" is not necessarily a formalised system, but rather a term used for the set of actors involved and the relations between them.

The concept "innovation" is then fundamental. How innovative are the different systems? In the Danish paper the authors present a definition of their understanding of the concept of innovation in this specific project as involving both innovation of technologies and innovation of processes and services, with the purpose, in both cases, of improving the situation of disabled people in the labour marked (Bengtsson and Sørensen 2008, this working paper). With a reference to Digman et.al. (2006), the Danish partner defines innovation as "the combining of new or existing knowledge in new ways, which improves practices".

In The Oxford Handbook of Innovation (Fagerberg et. al. 2005) Charles Edquist writes a chapter on Systems of innovation. *Innovation* is then defined as "product innovation as well as process innovations. Product innovations are new – or better – material, goods as well as new intangible services. Process innovations are new ways of producing goods and services. They may be technological or organizational". Edquist also defines *System of Innovation*: "the determinants of innovation process = all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion, and use of innovations" (Edquist 2005:182).

Our understanding of innovation and diffusion / innovation systems is in accordance with the way Edquist defines the concepts.

The national architecture studies

The object of the national studies was to present the actors involved in the diffusion system and the relations between them. The studies are concentrated on six main questions.

Who participates in the diffusion system (i.e. national and local authorities, NGOs, research institutes, producers, private companies, employers, employees)?

What characterizes the (system of) cooperation between these actors?

What characterizes the role of national or local authorities?

How do non-public partners in this diffusion system assess the role of public authorities?

How do producers of ICT adapt to the demand for universal design?

What barriers and bottlenecks can be identifies in the system?

In this introduction we will not go into all these questions, but mainly concentrate on the first two questions about the participants in the system and the relations between them. In the closing remarks we will go into barriers and bottlenecks identified in the systems.

Who participates in the diffusion system?

The papers show that several actors are involved in innovation, production, distribution and implementation of ICT for disabled people in working life. The actors could be categorized in some main categories:

- Governmental actors at national level
- Governmental actors at local level
- NGOs
- Producers and suppliers of assistive aid
- Producers and suppliers of general ICT
- Private service providers (workplace adjustments / employment services, occupational health)
- Research institutes / universities
- Employers and employees.

Within these categories there will again be different actors. In the different countries some actors are more involved and active than in other countries. The descriptive presentations of the actors involved in the different countries show that the Government is more involved in all phases of the diffusion system in Norway and Denmark. Private actors within the distribution and implementation phase are very involved in the Netherlands, although the services are often financed through the public social security agencies. These actors are also involved in the UK, although here the role of the NGOs /charities is the strongest. Both the Netherlands and United Kingdom have one national producer of assistive technology represented in the global market within the field of products for the blind and visually impaired; Optelec in the Netherlands and Dolphin Computer Access in the United Kingdom. In Denmark and Norway there are no national producers of assistive technology for the blind and visually impaired. Instead there is a large flora of small and middle-sized distributors represented in the national markets.

All countries have challenges related to the global actors in the market like Microsoft, Apple and IBM. Lack of universal design creates compatibility problems between general ICT and assistive technology, in addition to a constant lag between available new software programs and assistive technology that can operate with these new programs. In Norway and Denmark the government has chosen the standards to be used in the public sector. The goal is to exploit the large customer base formed by the public sector in order to influence ICT suppliers towards the use of open standards. In addition, Norway, in a new discrimination and accessibility act, demands that all new ICT directed towards the public should be universally designed by 2011. It still remains to be seen how this will affect the products from the global actors. At the global market level, the American anti-discrimination act, Americans with Disabilities Act (1990) has had some affect on stimulating universal design. The UK paper (Hill et. al in this working paper) illuminates the different strategies used by two of the main operating systems, Microsoft and Apple. Microsoft has adjusted to universal design by making a certification so that developers of, in this

example screen readers, can create applications, which are compatible with the MS operating system. Apple on the other hand has chosen to develop its own screen reader and integrated it in their PC package (Hill et. at this working paper).

We will not describe or sum up the actors in all these categories, but limit the presentation to a comparison of the roles of local and national authorities other involved actors, and NGOs in some of the countries.

Governmental involvement

The most striking finding when comparing the different national systems is the extensive role played by the government or public sector (at different levels) within the diffusion system in Norway. The government is to some degree involved and participating in all phases or stages of the diffusion system. The government makes regulations, finances research and development, assumes the role of the main customer for assistive aid, and is the main actor in distribution and implementation of assistive aid at work places. The role of the government in Denmark is almost as extensive, but, unlike in Norway, the Danish government does not to the same degree regulate the assistive aid market.

You find governmental involvement in all four countries, but the involvement in regulations, stimulations and financing is not as extensive in the Netherlands and the United Kingdom as in the Scandinavian countries. Both the Danish and Norwegian governments, for example, have regulated the ICT standards to be used in the public sector. There are governmentally funded research programmes in all the involved countries, but their scale and what they finance varies. Universities and research institutes involved in issues related to ICT and disabled will be found in all countries, but most extensively in the Scandinavian countries. Norway is the only country in the comparison that has a separate governmentally funded research programme for projects concerning ICT to disabled, with in addition, specific focus on employment. The programme, called IT funk, has very limited resources, but they play an important role not only in funding, but also in contributing to networking. Even though it is not possible to say that this programme has had a major influence on stimulating new ICT products or utilization of ICT products for the disabled, as stated in the Norwegian paper the evaluation shows that the programme has had good results (Hansen and Widding, this working paper). In addition mention should be made of additional programmes on different issues, under the auspices of the Norwegian Research Council, that fund projects of relevance for ICT, employment and disabled people. One example is the project behind this publication. This is a sign that the Norwegian government accepts responsibility for a social ICT policy and as well as for innovation within the utilization of ICT for social purposes such as the employment of disabled people.

In Denmark there are also governmental initiatives to stimulate research concerning ICT for disabled, but none of these projects seems to have employment as their main objective.

In the United Kingdom and the Netherlands the governments do not have any initiatives relating to ICT and employment for disabled people. Both the Netherlands and United Kingdom have governmental funding of research, and the United Kingdom has projects focusing on independent living and ICT, but these are mainly targeted on the elderly. It has to be said that there are no innovation milieus that are mainly concerned with ICT, disabled and employment in any of the four countries.

Regulating the connection between the participants

The users of assistive technology in Norway are not customers in the market themselves. The Norwegian government represented by the Norwegian Labour and Welfare Organization (NAV) is the only customer of assistive aid in the national market. Based on public tenders NAV works out an official purchase manual of approved products. This system does not exist in any other country and is unique. The Norwegian state has a monopoly as customer, and through their tenders decides whether a producer / supplier will survive on the Norwegian market.

Denmark does not have a system of approved products similar to Norway's. In Denmark the user can find the product they want / need and then apply for funding through the local Job centre. This opportunity exists in the Norwegian system as well, but if the user chooses a product outside the list approved by NAV, a specific application must be handed in where it is explained why one of the negotiated products are not chosen. If the application is approved, the supplier of the negotiated product not chosen is entitled to appeal the decision. NAV has also worked out rules for the workings of the contact between the Assistive Technology Centres (ATC) and the suppliers. The Norwegian government, through its price negotiation system and rules for the connection (how much contact and on which terms) between producers / suppliers and ATCs, regulates not only the market, but also the connection between the participants.

The Netherlands has a few national criteria for which products that will be approved or funded by the public social security offices (UWV), but not at all a comprehensive list of approved products like the Norwegian.

In the United Kingdom there are no such explicit regulations as in the other countries, but some implicit criteria are operated through the programme, Access to Work, by which persons with disabilities can apply for funding of products and services required at work. There is no formal guidance and no regulations which govern the type of products that will be funded, but the programme, which is administered by Jobcentre Plus (the national public employment service) and delivered through 'business centres' at a regional level, regulates the connection between the government, the user / enterprise and the actors contracted by Jobcentre Plus to implement suitable workplace solutions.

Neither in the Netherlands nor the United Kingdom do users have an explicit right to assistive aid in working life, and the state will not necessarily fully finance assistive technology. The situation where the state provides full funding of assistive technology has in many ways created a large market of assistive aid in Scandinavia, and several (non-Scandinavian) producers of assistive aid have national offices for distribution in Scandinavian countries.

Organization

The Norwegian system of Assistive technology is more centralized than the Danish, and the system for distribution is more organized. There are Assistive technology centres in every county responsible for serving also employees with disabilities; in addition work life centres and local authorities have a responsibility. As we see in the Norwegian paper the challenges are related to knowledge in the system about the different actors and about relevant new solutions. The Danish system is more locally based with the major responsibility given to the local Jobcentres. In the UK and the Netherlands it is not possible to talk about "systems" in the same way as in Scandinavia, but in the UK the programme Access

to Work is administrated by the national public employment service. The system in the Netherlands is more based on employers' responsibility to provide services and private Occupational Health actors.

Distribution and implementation

When it comes to distribution and implementation the government contributes with funding of assistive ICT for disabled people in employment in all countries. But the degree of funding and the involvement of the government in the process vary. In the Scandinavian countries the governments are more generous in product funding and are more involved in assessments of needs as well as in distribution and implementation of products than in the other countries.

Both the Dutch system and the system in the United Kingdom are more fragmented than the Scandinavian system and they involve several nongovernmental actors. In the Netherlands employees in need of assistive ICT are to contact the Occupational Health Service for their employer. The system of payment varies: employers pay some part of the cost themselves, but can also get funding from the national public social security (UWV). Employees themselves can also directly ask for funding from UWV. The Occupational Health service provider marked has since 2002 been privatised in the Netherlands. When a person with disabilities is looking for a job he or she has to go to UWV for an assessment of needs. The follow up will be given from private return to work service providers that will help the person to find a matching job. These service providers are contracted by UWV. Within the area of visual impairments there are two specialized service providers.

In the United Kingdom follow-up work, assessment of needs and adjustments at work places are frequently conducted by professionals working for NGOs (charities) contracted by the regional business centres of Jobcentre Plus. Within the area of visual impairments the Royal National Institute of Blind People (RNIB) is a major player.

In the Scandinavian countries some private actors have been involved in the distribution / implementation phase the past few years, but they still play a minor role. The NGO can in some cases, more so in Denmark than in Norway, be asked for advice or guidance on which products are available and what to choose, but they are not directly involved in this process.

The involvement of NGOs in the systems

The government's involvement in the Norwegian system is one of the striking findings from module 2. Another striking finding is the role of the NGOs in the UK system.

In Denmark and Norway the link between the government and the NGOs is very close. The NGOs in both these countries, as well as in the Netherlands, are users' organisations. This means they are organizations of disabled people, or representatives of disabled people. In Norway and Denmark organisations of disabled people have formal representation in several official committees and regular meetings with the government. They are very active in influencing policy, but they seldom engage in providing service. We had expected to find a tighter bond between producers / suppliers of assistive aid and NGOs, but that bond is almost nonexistent in Norway and neither does it seem to exist in Denmark nor the Netherlands. The suppliers / producers relate to some individual users, and

not organisations. They prefer some "super users" that they have established a relation to, and rarely deal with organisations.

In the United Kingdom the role of the NGOs is somewhat different. There are organizations of disabled ICT users in the UK, but the most active NGOs in this context tend to be the larger charities. The user organizations are less visible in the system. There are several charities active in the field of distribution and implementation. For the visually impaired the main actor is the Royal National Institute of Blind People (RNIB) who serve as advocates for the visually impaired population, providing basic information about accessibility and available ICT products. RNIB also carries out workplace assessments and supports ICT implementation on an individual basis. There are several other NGOs which have websites providing information related to ICT, disability and employment. These factors contribute to a picture of the UK system which is arguably quite fragmented because there are several small actors, with no single agency responsible for coordinating the system.

What characterizes the system of cooperation between the actors?

Placing the four countries along a scale from regulated to non-regulated, Norway will be found in the regulated end and the United Kingdom in the other end.

Regulated			Non regulated
Norway	Denmark	Netherlands	United Kingdom

Norway and Denmark are small countries with an active state in the area. This governmental engagement is not equally visible in the other countries. At the same time there is one thing that seems to lack in all the countries, and that is meeting places or bridges between users / employees at work places and the innovation milieus / producers. There are no systems for communication of needs between the workplace on the one side and innovation milieus or producers on the other side

In the area of information about available products the situation is different. Denmark has had many innovations of processes and services in this area the last years. A large structural reform has led to a situation where local job centres have the total responsibility for disabled people and employment. This includes the responsibility for assistive ICT aid as well. To support this responsibility of the Jobcentres the government has contributed to funding of a web portal www.ijobnu.dk to provide more information to employees at the jobcentres, employers wanting to hire disabled people and disabled people. This web portal contains information about employment, available assistive aid and compensating measures.

In the United Kingdom there are several websites like this provided by NGOs (charities). In Norway and the Netherlands there are no examples of this type of information gathering. There are no available websites at the moment where employers can get information on available assistive aid, and on how to make their work place more accessible for disabled employees.

Closing remarks

As stated in the beginning of this introduction, this must be considered a work in progress. When the third module of the project is completed we will have better understanding on how these systems influence the access to ICT for disabled people in employment. How do these systems work when it comes to making bridges between the actors and how does the relation between the actors influence on innovation of products and processes?

From a Norwegian perspective the papers from module two raise some questions related to the overall involvement of the government and governmental actors in the diffusion system. In all the other countries, also Denmark, the government plays a more detached role. Does the Norwegian system manage to serve the users with the competence and products they need? In the Norwegian paper they point at lack of competence and knowledge about available and relevant solutions and products as a main bottleneck in the system. A central question is whether the public mainstreamed system is the best solution to provide good services in this field. This question is in a large degree also relevant for the Danish system.

We have seen that the Dutch system has privatised the service provision in this area[3]. Is it possible to see that this in any way affects the service provision to end-users in a positive or negative way? Does this way of organizing services lead to a more specialized system, better able to provide competent and individual services than the Norwegian general public system? In the United Kingdom the NGOs play an important role in the distribution and implementation phases. Is the competence of these more specialized actors higher than the more general services from the public Assistive technology centres in Norway or the suppliers that most often have the responsibility for implementation at work places? How do the users assess the services they receive?

Funding is of course important. We find different systems of funding in the four countries. All have some kind of governmental funding, but United Kingdom is the only one with a program funding. A very interesting question is whether the restriction to program funding results in a less generous system in the United Kingdom. Does this way of organizing the system lead to strict limitations on what products are approved and on the training of employees in the use of assistive aid?

This project is occupied with Universal design. The papers have all shown that there are challenges related to a lack of universal design and disabled employees' utilization of ICT. At the same time we do not find Universal design articulated in the same degree in the countries outside Scandinavia as in Denmark and Norway. At the same time the architecture study shows that the American with Disability Act (ADA) has influenced the innovation related to general ICT. Many products, like the products of Microsoft, have become more user-friendly recently. This shows that regulations do have some effect, but that this potential is possibly not fully utilized in relation to ICT, disability and employment in any of the countries under consideration.

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[3] Many of the services are financed by the government, and there is a regulated system of responsibility of service provision and adjustments for employees with disabilities.

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Chapter 1. Actors involved in the field of disability, ICT and employment in Denmark

BY: Steen Bengtsson and Thilde Sørensen

This chapter investigates the Danish system and organisation of innovation, production, distribution and implementation of ICT-based general and assistive technology available for and utilized by people with disabilities, in conjunction with their working lives.

The aim is to map the actors within the field. That is, we want to find out who they are, what are their tasks and their roles, how they are financed, with whom they cooperate and what the actors respectively consider as important barriers for a frictionless chain of innovation – production.

The central actors who largely constitute the systemic architecture within the field of disability, ICT and employment are identified, starting with an analytical division of the actors into the four categories of innovation, production, distribution and use / implementation (see fig. 1). The intention is hereby to gain a more precise overview of otherwise complicated issues, though *not* implying a linear logic between the categories. Similarly, it is entirely for analytical purposes the actors in the following are placed in separate categories, with allocation based upon their *primary* role. The multiplicity of forms and functions the various actors assume is expanded upon later.

Figure 1: Mapping the main actors within the field of disability, ICT and employment.

Innovation	Production	Distribution	Use & implementation
Government The Ministry of Science, Technology and Development KIA (The Competence Centre ICT for All) The Ministry of Employment National Labour Market Authority (AMS)	Private-Public Consortia Alexandra-institute The IT greenhouse: '5te' Knowledge networks e.g. 'Komialt' (pervasive communication) Small user-driven companies	Government The Ministry of Social Affairs The Ministry of Employment Jobcentres Local Assistive Technology Centres	Employees/ job-seekers Need information and advice on solutions and their use. Employers Need information and advice on solutions.
Interest organisations DH (The Danish Council of Organisations of Disabled People) and its member organisations CLH (The Centre of Equal Opportunities) DCH (The Central Disability Council)	Specialized IT companies Universal IT companies	Nationwide Knowledge Centres HMI (The Centre of Assistive Technology) Specialfunktionen Job & handicap, Vejle (The Specialist Centre on Employment & Disability) Municipalities	Implementation tools www.ijobnu.dk 'Icebreaker' schemes and compensation schemes Initiatives directed towards (future) employees as well as (future) employers.
Research institutions Universities Research Centres Research networks		Special pedagogical support at educational institutions	

Obstacles and sub-optimality

The overall responsibility in a world of networking? – VISO, Ministry of Science
How much is it a question of compensating function?
How to maintain responsibility under sector responsibility?
How to combine the parallel systems in order to avoid sub-optimalisation?

Firstly, we will further describe the systemic architecture. Secondly, we will analyse the relations between the actors and identify potential barriers. Thirdly, we will comment on these obstacles and sub-optimalities within the system and finally, we summarise the barriers, which have been identified in the paper.

Data and background information

The analysis in the paper is based on six qualitative interviews in 2007 and an earlier interview from 2003 with actors within the government, production, NGO's, distribution and a visually disabled person.

Disabled people in Denmark between 16 and 64 years of age are surveyed in a publication that will appear summer 2008. This survey estimates the number of persons with reduced sight to 152.000. 45 % of these have just slight visual reductions, but 55 %, or 83.000 persons, have visual reductions with some consequences. 56.000 have difficulties in

text reading with normal newspaper print, and 27.000 have difficulties with reading even with large print, or cannot read at all.

Description	Number of persons
No measurable reduction	69.000
Hard to read normal newspaper print	35.000
Hard to recognise friend at a distance of 3–15 meter	21.000
Cannot read book with large print	12.000
Cannot recognise friend quite close	15.000
Total	152.000

As impairments are often combined, most of the visually impaired persons have other impairments as well. Only 30.000 of the abovementioned 83.000 have visual impairment as their main impairment.

Women more often report disability than men do. Whereas the age group 16-64 years contains 49,9 % women, the group reporting disabilities contains 56,6 % women and the group reporting visual impairments contains as much as 61,7 % women. There are however some indications in the survey that men are underreporting their impairments.

Disability is related to age. Whereas 20 % of the population in the age group 16-64 is more than 55 years, the same holds for 28,5 % of persons reporting disability and for as much as 36 % of the persons reporting visual impairments.

The research on disability and employment in Denmark shows that the number of disabled persons in employment has been growing since the beginning of the century, although the number may vary from one survey to another. In this survey we find that the percentage of employed persons in the whole age group is 71,3 %, among persons that report disabilities it is 57,9 % (a percentage equal to what has been found in other surveys), whereas visually impaired persons only have an employment rate at 46,8 %.

At a first glance, it seems that visual impairment is a greater impediment for employment than most other types of disability. Closer analysis shows, however, that this difference is only due to the special sex and age composition of the group of visually impaired persons. Intellectual and behaviour impairments reduce employment more than visual impairment does, and mobility impairments have about the same effect on employment as visual impairment has when sex and age are constant.

Actors involved in the field of disability, ICT and employment

We will describe more completely the systemic architecture and the actors involved within the field. The focus will be on description of the different actors and their tasks and roles and on how they are financed, or how they finance initiatives within the field.

Innovation

To describe the system of innovation, two separate understandings of the term are included here, respectively *innovation of technologies* and *innovation of processes and services*. In both cases the goal is to improve the situation for people with disabilities within the labour market. The term "innovation of technologies" refers to innovations in which technologies are used to improve the situation of people with disabilities within the labour market. An example of this is the recent development of a Danish speech-recognition programme, Dictus. The term "innovation of processes and services" refers to innovations in which services and processes are enhanced, often by using technologies, thereby improving the access to the labour market for people with disabilities. An example of service and process innovation could be the portal www.ijobnu.dk, which is a knowledge-sharing tool improving the access to qualified knowledge in the form of a database, which cross-links information on assistive aid with information on job requirements or abilities to function. The structural reform regarding the jobcentres' services for people with disabilities has the potential to be another example of innovation of services and processes, assuming that it leads to improved practices, which is currently a hotly debated topic. This leads us to a definition of innovation as "the combining of new or existing knowledge in new ways, which improves practices."[4] To this definition should be added that innovation can be initiated either as a top-down or bottom-up process and that innovations can take shape as universal or specialized technologies or processes.

According to NITA, the system of innovation in Denmark is mainly characterised by a great reciprocity in innovation processes initiated by the government and other governmental organisations on one side and users and user-driven organisations on the other. Core factors are undoubtedly both general developments that make ICT less expensive and more powerful, as well as public sector investment in Danish ICT-leadership. This means the infrastructure includes widespread broadband, digitisation of public and private services and the general existence of ICT skills on a level where users are able to locate or even make improved programmes or add-ons themselves.

Another main characteristic is the implementation of the principle of sector responsibility, which has the result that policy making regarding disability, ICT and employment issues is split between the sectors of employment and technology and the two respective branches of governmental institutions.

Government

The last years the Government has been intensifying the workfare policy to get more people outside the labour market into a job and in October 2006, they introduced 12 new initiatives for people with disabilities.[5] In Denmark, the Ministry of Science, Technology and Development (hereafter MSTD) and the Ministry of Employment and their respective agencies have primary responsibility for policy regarding disability, ICT and employment, and as such initiate the main strategies and direct the prime foci within the field. As such

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[4] Digmann, et.al.2006:13

[5] http://www.bm.dk/graphics/dokumenter/temaer/handicap/initiativer_oktober_2006.pdf

the National IT and Tele Agency (hereafter NITA) is an agency under the MSTD, and KIA (the Competence Centre ICT for All) is a part of NITA, and they are both central within the field of innovation. The Ministry of Economics and Business Affairs and the Ministry of Finance however, do also play important roles within the field. The general Danish government policies as well as the recent EU ministerial declaration on ICT for an inclusive society (E-inclusion) signed in June 2006 refer to the double aim of ensuring equal ICT access for all, as well as increasing initiatives using ICT to achieve wider inclusion objectives[6]. Thus both at the EU level and the Danish level, the process and technology types of innovation receive attention. According to Danish labour market authorities, the strategies have so far resulted in the satisfaction of the ambitious goals that every year 2000 individuals with disabilities should find employment and that every year the proportion of companies employing a person with disabilities should increase by one percentage point[7].

The Government functions as initiator in different ways. For instance, the Government has introduced *open standards* in all public sector digital projects in order to ensure that individuals with disabilities are not prevented from functioning in public sector workplaces by technological developments. And NITA is working to ensure equal access through broad, high profile policies such as digitising the public administration, e.g. via the implementation of information platforms and the digitisation of all communication between public bodies and citizens. The Government also plays a crucial role in financing new projects and supporting initiatives within this field, which might not otherwise have seen investments of this kind realised, as this type of investment does not have earning potential within the small Danish market. Projects like these often take form as partnerships involving a wide range of actors who all contribute with resources, as was, for example, the case with the recently released Danish speech recognition programme Dictus, which was developed in a partnership between the Ministry, TDC (the main telecommunication operator in Denmark) and a range of NGOs.

Non-governmental organisations

Another important actor in the field of *Innovation* are the NGOs. When talking about the NGOs it should be stressed that, the Central Disability Council and DH are *public* interest organisations whereas the respective disability organisations are *private user-driven* organisations. The NGOs' role as initiators are many since they both support new projects with financial resources and knowledge as well as by applying pressure to the respective ministries to take initiatives and to support projects, which was the case with Dictus. This case is a good example of the ability in Denmark to combine top-down and bottom-up perspectives in innovation of technologies and processes. The organisation of these processes is formalised within the Central Disability Council, which includes representatives from both disability organisations, individually and jointly within DH (Danish Council of Organisations of Disabled People) as well as the relevant ministries and public organisations such as the Centre for Equal Opportunities. The Central Disability Council plays a crucial

[6] EU 2006:1

[7] AMS 2007. For the period 2002 - 2005, the increase turned out to be four times as high (24.000), Miiller et al (2006).

role as the broker and communicator of a general disability perspective representing a broad range of disability organisations as well as representatives from ministries and municipalities. According to DH, the disability organisations channel a great part of their influence through CDC, where they have half of the ordinary places. The NGO's (public as well as private) are active both within the field of innovation of technologies as well as in the field of innovation of processes and services as they have been involved in the development of Dictus and the development of www.ijobnu.dk.

Research institutions

The category 'research institutions' incorporates universities, research centres and other institutions involved in research into assistive technology for both universal and specialized purposes. One institution that has been drawing particular attention to itself in relation to assistive technology useful for people with disabilities is, among others, Aarhus University, with its Centre of Pervasive Computing[8]. This centre constitutes the focal point for research located in a district now known as the 'IT City' of Katrinebjerg, because Aarhus University managed to create a unique innovative environment attracting several IT-related companies. Katrinebjerg can be considered a Danish-sized 'Silicon Valley' and is still the national leader within the field. The Centre of Assistive Technology (HMI) with its main department in Aarhus contributes to this picture.

Close behind is the still relatively new IT University of Copenhagen, which has also established an innovative environment of their own, the so-called 'greenhouse on the 5th floor' (named after the location on top of the university) where public research and innovative private IT-related companies also benefit mutually from the common location.

Other research centres worthy of mention here due to their contributions to assistive technologies, although not comparable in size or scope to the two others, are the Danish Technological Institute, and Aalborg University at which HanDiaTek, the Network of Disability, Dialogue and Technology is located. Furthermore, due to the integration of the Danish Building Research Institute and the Danish Centre for Equal Access in conjunction with the recent university reform, both entities now constitute a considerable capacity in regard to work-related assistive technology and to equal access for individuals with disabilities, especially in regard to the implementation of assistive technology in building construction.

Research and projects regularly take place in cooperation between universities and/or research centres and private companies. Often, consortia such as the Alexandra Institute, which is a research-based limited company that bridges the gap by promoting cooperation between private companies and research institutions, are initiating new projects. Normally, the company finances the first 50 % of the project and different actors such as research programs and EU finance the last 50 %. The research institutions sometimes finance researchers in a project but only to a limited extent. Consortia and the Alexandra Institute

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[8] The term "pervasive" indicates the tendency towards the gradual integration of information technology in more and more conventional industrial products. Internationally it is estimated that "pervasive computing" will be the next large wave of development and in Denmark the Business Promotion Agency has pointed out "pervasive computing" as the most central aim within IT and communication (www.katrinbjerg.net).

will be further described in the next part. The government and the NGOs also support and initiate research and projects, the government especially through research programmes. In addition, KIA supports and has supported a range of projects with the purpose of enhancing the accessibility of ICT.

Small innovative private companies

Finally, a large resource that should not be overlooked in this matter is the number of people with disabilities (and/or their relatives) who are able to locate or develop/manipulate assistive technologies according to their needs and in this way improve their situation in relation to the labour market. The Danish Rehab Group points out that a growing number of university-based companies, founded by students with disabilities are promoting specialized assistive technologies, which they have developed, inspired by their own needs.

An example of this is the company CePa, which consists of four students from the National Technological Institute, two of whom are motor disabled, that has developed a discrete form of communication integrated into a mobile phone operating system specially designed for motor disabled. The tool enables the disabled individual to communicate independently because it works without buttons, so that the mobile phone is operated through two states, as in yes or no (a so-called '01 switch'), with different motions adapted to the users functioning range, e.g. with the chin, finger, knee or by blowing into a tube. [9]

Another example of a university-based company is the company SoundScapes, which is a SME company whose possible profit always is reinvested in the science. The founder is a senior lecturer at Aalborg University/Esbjergs' Institute of Technology, whose uncle had severe disabilities. Soundscapes focuses on the development of personified interface technology with the main purpose of (non-formal) rehabilitation using play as a motivator. The aim is that everybody should be able to use the system and thereby achieve a positive effect; that is by means of the use of one's body, a limb or head to be capable of expressing oneself and thereby achieving a higher and a better quality of life. Soundscapes' work can also be used for other purposes and now the company is involved in several projects as for example rehabilitation after a stroke in a virtual reality environment and rehabilitation of people suffering from PTSD.[10]

Production and supply

One of the main characteristics of the system of the production of assistive technology in relation to the labour market is that the areas of innovation and production are increasingly closely related and mutual learning often takes place in innovative environments or broad networks.

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[9] www.cepa.dk

[10] www.soundscapes.dk

Furthermore, the relatively small population forms a basic condition for all production of assistive technologies in Denmark, i.e. the market potential is rather small and further decreased the more specialized the technology is, and therefore there is a high degree of dependency upon public sector funding or private sector commitment.

As public support for the use of technological aids by people with disabilities is on a high level, there is a home market for these products. The support of technological development then creates possibilities for a great export, which can sustain a production. It is worth noting, furthermore, that some specialized assistive technology is produced with a specific aim in mind, but then later on adapted for other and more general purposes and vice-versa.

Universal and specialized IT suppliers

NITA underscores the fact that a large number of small and middle-sized suppliers make up a considerable part of the landscape of Danish ICT. Nevertheless, the large universal suppliers, such as Microsoft, Apple, HP and IBM, probably are the main suppliers of universal software and/or hardware. These companies play an important role with regard to assistive technologies through their willingness to collaborate with the governmental and private partners. The recent agreement between Microsoft and NITA exemplifies this collaboration in which Microsoft partially agrees to support interoperability between WS-Federation and SAML 2.0 based products, which is the chosen standard for the Danish public sector[11] (the open standards issue is elaborated further later on). Smaller specialized suppliers are very dependent on the collaboration with these companies too, for ensuring the interoperability of specialized assistive technologies with the universal technologies.

Apart from this, the landscape of specialized IT suppliers can best be described as made up of a broad range of companies, which supply disabled people with assistive technologies for job purposes mainly through the jobcentres. A look at the assistive technology database from the Centre of Assistive Technologies provides the most direct evidence of this.

Private/public consortia

The concept of consortia consisting of public and private investors has in Denmark, like in many other places, spread to an extent that the number of assistive technologies of all kinds has increased significantly. This type of consortium is, basically, a formalized network or partnerships in which a technology and the use of it provide the focal point together with the potential for financial gain. The purpose is to improve the assistive technology generally available to people with disabilities. Consortia are often necessary to provide the necessary investments so that the technology can be produced and marketed. Consortia are often related to research institutions, which also often appear as shareholders in consortia. An example of such a consortium is the already mentioned (2.1.3) research-based limited company The Alexandra Institute that bridges the gap and promotes cooperation between private companies, other organisations and public research units. The "IT-association Alexandra" owns the Alexandra Institute and the members of the

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[11] OIO (2007)

association pay an annual royalty of service to the Alexandra Institute. The Institute originated in Katrinebjerg at Aarhus University, and now has expanded to the Copenhagen IT University too. The Alexandra Institute's primary task is to match private companies and research units and to direct the project. Projects are normally financed by the companies that take part and by public research funds such as research programs, EU and the research institutions. However, the research institutions only support with finance to a limited extent. The Alexandra Institute has been involved in several projects on specialized assistive technology for people with disabilities.[12]

DRG – Danish Rehabilitation Group

DRG is the trade association for Danish producers and suppliers of assistive aids and services within the field of assistive aids and care. DRG represents a broad range of producers, distributors and other firms engaged in the field, such as services, education and exhibitions. Most of the members are small and middle-sized firms. DRG has two primary tasks. One task is to take care of the interests of the distributors of assistive aids and to be the mouthpiece of the different firms towards the many public and private interested parties, which have an influence on the terms of reference of the trades (market within this area). The other task is to service and advise its members on conditions relevant for both group and individual interests. Furthermore, DRG supports its members in establishing a foothold in the international market through export drives, participation in international exhibitions, cooperation with organisations and actors, participations in and holdings of seminars etc.[13]

Distribution

The system and organisation of distribution of assistive technologies in relation to the employment of people with disabilities has undergone great change recently, because of a recent reform of the municipalities. One of the reform strategies was to ensure the existence of only one public sector gateway to the job market, making the jobcentres and their supportive knowledge network by far the main actors characterising this field. However, other actors have relevance to the system and organisation of distribution, which means that the support for special needs within education is also mentioned in this section.

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[12] http://www.alexandra.dk
[13] www.drg.dk.

Public actors

Jobcentres

As mentioned above, there has been a reform of the municipalities, which took effect from January 1st. 2007 and which has resulted in great changes in the system of getting people into employment. The reform included three reforms:

a) A structural reform reducing the number of municipalities from 275 to 98 and increasing the size of municipalities, abandoning the previous 'county' governments (Amter) and turning responsibility for the production of health services (hospitals and health insurance) over to the 'regions'.

b) A reform of the assignment of tasks involving changes in the responsibility for, and organisation of, public services.

c) A reform of the financing of the public administration.

Of particular relevance for this paper is the transfer of responsibility for employment entirely to the 91 local jobcentres, which resulted from a merger of the previous public employment services and the municipal services working with other employment initiatives. The jobcentres are responsible for serving all employers, employees and job seekers, which means they are also responsible for the administration of the various schemes available for people with disabilities (The Law on Compensation to Disabled Persons in Employment from 1998[14], amended in 2000 & The Law of Active Effort for Employment, revised in 2003). This includes providing grants for assistive technologies, work-related education material and small-scale adaptations of the workplace according to the assistive aid scheme, as well as an examination of the ability to function and the possibilities of compensating people with disabilities. [15]As this is a new organisation, the job descriptions are not yet finalised. However, there has been established a Specialist Centre on Employment & Disability (Specialfunktionen Job & Handicap) in Vejle to advise and enhance the skills base of all the jobcentres.

Given that the reform is still very new, it is too early to evaluate the results of the changes. However, much concern has been expressed from both professionals and interest organisations regarding the effect on the quality of services resulting from the relocation of specialized knowledge environments to each of the local jobcentres. This will be further developed in the section on the relations between the different actors.

VISO – National Knowledge and Special Needs Advice Service

VISO, established in relation to the municipal reform, was implemented January 1st. 2007, and is available to provide specialist knowledge on less common disabilities to people with disabilities, as well as to municipalities and institutions. VISO consist of three parts:

The Central Unit, which is the base of VISO, coordinates the supply networks

The Network of supply, which is the backbone of VISO

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[14] HIT 2/2006, p. 19

[15] Leif Scherrebeck (Interview 2007)

The Knowledge Part, which is managed by, among others, 14 organisations who are all related to the field of disability and mental health. This part is currently under construction.

HMI – The Centre for Assistive Technology

HMI, a nationwide centre, is the main actor regarding the development and communication of knowledge relating to assistive technologies. HMI contributes to inclusion of, and the best possible terms for, people with disabilities. This is, among other initiatives, taken care of through their comprehensive database on assistive technologies, which is implemented in the portal www.ijobnu.dk. HMI is therefore an important actor in the field of innovating processes and services. The Centre also helps producers of assistive technology with tests and consultancy on safety, durability, ergonomics and functionality. HMI participates in many networks and partnerships and in this way plays a crucial role within innovation as well. We have chosen, however, to place HMI amongst distributors since above all it contributes to and disseminates knowledge about disability and assistive technology. Since 1 January 2007, HMI has been an independent institution under the Ministry of Welfare and VISO. As such, the Centre is financed by regular grants from the Ministry of Welfare and by commercial activity, which cover operating costs.[16]

Vidensnetværket - knowledge about disability, chronic diseases and employment

Another important initiative for increasing knowledge about disability/diseases and employment is the newly established secretariat Vidensnetværket (The knowledge-network). Vidensnetværket was initiated on 1 October 2007, runs throughout 2010, and is financed by The National Labour Authority (AMS). Vidensnetværket is rooted in DH and builds upon the knowledge and experiences of the organisations within DH as well as other persons, centres and institutions who support the portal through a row of networks. The aim of the secretariat is to gather and disseminate knowledge about disability/diseases and employment and thereby help people with disabilities or people suffering from chronic diseases to get closer to the labour market and find employment. It specifically caters to: a) employees in the jobcentres, b) other actors within the employment effort and c) citizens with disabilities/diseases who should be kept in, or integrated into, the labour market. The secretariat offers guidance on concrete cases; general view over institutions, centres, organisations etc. within the field and in addition supplies the jobcentres with inspiration and courses on topics such as, for example, disability/disease and working capacity. [17]

SPS - Special needs support within educational institutions

Another perspective that should be included in this paper is that of the function that the educational institutions play. Since 2001, SPS, the Special Needs Support, which is part of

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[16] www.hmi.dk

[17] www.vidensnetvaerket.dk

the national student grant scheme (SU), has arranged for the support of an increasing number of students with disabilities[18], including all those situated within continuing and higher education institutions. This perspective is relevant for this paper for two reasons: Firstly, attention should be paid to the support arrangements for special needs by which the educational institutions compensate students with disabilities. Assistive technologies play a large part in these efforts. The sooner this happens, the sooner students with disabilities will attain more equal opportunities with regard to participating in the education and the labour markets later on. Education is by all accounts a crucial development stage in shaping the individual's (and others') perception of him/herself and range of options in life, which again have great influence over the choices the individual makes (or is presented with), and thus the special needs support in education is crucial to inclusion in the labour market. Secondly, educational institutions are responsible for the general career guidance arrangements which are closely connected with the support arrangements, and which students with disabilities are highly dependent upon with regard to making career choices.

An illustration of this is a recent study by the University of Aarhus suggesting that the transition from education to employment is a major problem for people with disabilities and that sufficient resources to support these people are not available. The study concludes that the lack of resources is a barrier for the implementation of means to clarify job competences (such as focused guidance on these issues) as well as means to gain relevant experiences (such as internships) which the report concludes is critical to the integration of people with disabilities within the labour market. The study also argues that insufficient resources result in a lack of actual needs assessments and distribution of assistive technologies, which means students under-perform because they do not have access to the relevant available assistive technologies[19].

Private consultancies

Even though the jobcentres are the main actors in getting disabled people outside the labour market into employment private consultancies play an increasing role in getting disabled people into employment. Sometimes consultancies have arrangements with the municipalities and as such assist the jobcentres. Other times, the disabled person himself contacts a private consultancy.

Implementation

This section highlights the relevant systems and organisations regarding the implementation of assistive technologies, where the term 'implementation' here is understood as the implementation of the provided assistive technologies including the dissemination of

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[18] Inger Kirk Jordansen, HMI (Interview 2007), estimates this.

[19] Aarhus Universitet (12.3.2007)

knowledge, the training of end-users as well as the guidance to the employers supportive of employees with disabilities participation within the labour market.

The employee/job-seeker in need of assistive technology

The most important actor in implementation/use of ICT is the employee. There will be different groups of employees in need of assistive technology. There will be employees with a well-known need of assistive technology whereas there are other employees whose need is not defined or who might not know that there is assistive technology available to increase their abilities at the workplace. In addition, it is also very important that the employee be well trained in the use of the assistive technology if he/she is to get an optimal use of the aid.

Employer/company

Another important actor for the implementation is the employer, who hires employees and therefore must be involved in getting available ICT implemented. The employer has the overall responsibility for having the right equipment, including assistive technology, so that the employee can fulfil his/her assignments.

Assistive technologies for employment of people with disabilities

Assistive technology is often one part of the overall job solution for people with disabilities, but often more initiatives are necessary, such as better information and the breaking down of the barriers preventing individuals with disabilities from being employed within a particular workplace. A variety of schemes exist directed towards the implementation of the political intentions of getting more people with disabilities into the labour market. This includes salary subsidy available for employers who employ people with disabilities in their first job, affirmative action for public sector jobs for people with disabilities who are otherwise qualified for the job, as well as a national scheme for personal assistance.

www.ijobnu.dk - portal for the disabled and their (future) employers

An important initiative for increasing the knowledge about job opportunities for people with disabilities is the portal www.ijobnu.dk and the portal is, as mentioned in the beginning of this paper a fine example of "process and service innovation". The Portal combines employer and employee information and performance clarification with a well-developed database of assistive technologies, run by the Danish Council of Organisations of Disabled People, labour market associations and several private employers, the Centre for Assistive Technologies, as well as the jobcentres. This means it is possible for any potential employer/employee, by inputting the job conditions as defined by functionality and the work environment, to get targeted information on relevant available assistive technologies, as well as information on who to turn to for the next steps. The portal has a service function with which employers or employees search in a database, which links information on job requirements to information on different physical/mental disabilities, and

further, via cross-references to the assistive technology database of the Centre for Assistive Technology, to information on relevant assistive technologies.

Compensation certificate for pre-approving people in reduced-hours jobs

A recent initiative, to which great expectations are attached, is the arrangement that people with disabilities, who are already referred to a reduced-hours job, can receive a compensation certificate, which ensures their right to a reduced-hours job. Actually the certificate ensures the disabled person a right to a certain percentage of wage subsidy (50 %, 65 %, which compensates for the missing working ability), as well as ensuring the right to the necessary assistive technology. Formerly, the referring to this type of compensation was linked to the specific circumstances in the job, which meant the jobcentre would have to decide if for example the job in question could lead to a compensation of the salary up to 1/2 or 2/3 for the specific employee and his/hers functioning. In practice, this led to a kind of negotiation between the jobcentre and the employer on the level of compensation and this was problematic with regard to the due process according to established rules and principles[20]. As such the compensation certificate considerably improves the process of employing people with disabilities in reduced-hours jobs, among other things because the employers achieve a clear overview of the possible compensation arrangements for job-seekers with reduced functioning, which apart from the compensation of salary, can include which assistive technologies the employee has been granted upfront. This means that the transparency of the arrangement for the employer and for the employee is improved in relation to who the responsible authority is, so that the process is more a case of the competences and abilities of the employee, rather than the formal arrangements. The compensation certificate is expected to give people with disabilities more options when searching for jobs.

HMI, VISO and the Network of Knowledge
As these three institutions gather and disseminate knowledge on disability, ICT and employment they also play an important role in implementing assistive technology at workplaces as they give guidance to employee, employer and municipalities on solutions that will help the employee. HMI in many cases also work with assessment and installations at the workplace.

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[20] Leif Scherrebeck (Interview 2007)

Relations between the actors in the system

In this section we analyse the roles and relations between the actors within the system. First, we focus on the relations between the system of innovation and the system of production. Second, we focus on the relations between the system of distribution and the system of implementation. When focussing on relations between the different actors our focal point has been on how the actors experience these relations. Finally, we identify the possible obstacles and barriers within the systems to the full exploitation of ICT in getting or keeping disabled peopled in employment.

The innovation and development phase

The system of innovation and production in Denmark is mainly characterised by a great reciprocity in the innovation processes where the government and other governmental organisations on one side and users and user-driven organisations on the other side initiate initiatives. Similarly, the system of innovation and of production is increasingly closely related and mutual learning often takes place in innovative environments or broad networks. As mentioned earlier we use the term *innovation of technologies* and the term *innovation of processes and services*, in both cases with the goal of improving the situation for people with disabilities within the labour market. In addition an actual definition of innovation must be seen as; "the combining of new or existing knowledge in new ways, which improves practices"[21]. Our understanding of innovation includes the notions that it can be initiated either as a top-down or a bottom-up process and that it can take shape as universal or specialized technologies or processes.

The Government
The Government is related to many of the actors in the field of ICT, disability and employment. Regarding the field of innovation the Government is related to the NGO's, the producers and the research institutions. The Government's policy and regulations have great influence on the field, as does the amount of money it distributes to the field through research programs and different funds. However, much of the policy and the regulations are developed in cooperation with the NGO's - public as well as private - that have great knowledge about what is missing within the field. The Government also facilitates networks within the field of innovation and as such, it has set up a committee consisting of the NGOs, officials from the ministries, the industry and the municipalities who

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[21] Digmann, et.al.2006:13

meet three times a year to discuss systems and how they work, which new initiatives are to be taken etc.[22] Moreover, the Government supports initiatives within the field, which might not otherwise have been realized. This is not always because of the Government's good will, however. Rather, it is due to hard pressure from the NGO's, which was the case with The Danish speech recognition programme, Dictus. Regarding the field of distribution, the Government is related to all the public actors and again it is because of policy, regulations and money. The jobcentres are responsible for implementing those regulations and initiatives designed to increase the number of people with disabilities in employment, such as the compensation certificate mentioned in 2.4.5. Moreover, the government finances, either directly or through regular grants, VISO, Vidensnetværket and HMI- Vidensnetværket is also initiated by the government in cooperation with the NGOs. Furthermore, to comply with problems in the field of disability caused by the principle of sector responsibility, the Government has established a cross-ministry committee that deals with questions concerning disabilities in which officials from the responsible ministries are attending. They meet regularly to discuss problems which might occur such as misunderstandings between the ministries and whether people with disabilities fall outside the system. They also discuss how new initiatives could be done to prevent problems concerning sector responsibility and how to make further improvement within this field.[23]

As sector responsibility is an important principle in Denmark, we shall present a short description of this term. Sector responsibility is a principle, which regulates the relation between service to disabled people and service to non-disabled people. Before the time of the social state special services were provided for people with disabilities. As services for people without disabilities have grown, a choice has arisen regarding the continued existence of special services and special care, or if services for people without disabilities shall be made accessible to people with disabilities as well. The last option is termed sector responsibility, in English often mainstreaming. This principle has its pros and cons. Special services easily become isolated and backward. Sector responsibility on the other hand is difficult to maintain, as disabled people everywhere will be a little minority that is easily forgotten.

As mentioned in 2.1.1, the Government has been intensifying its policy to get more disabled people inside the labour market into employment and has increased focus on digital inclusion by emphasising accessibility. One way of achieving this goal is the introduction of *open standards* in all public sector digital projects in order to ensure that individuals with disabilities are not prevented from functioning in public sector workplaces by technological developments. Unfortunately the standards only contains recommendation concerning accessibility for all, despite the fact that this has a great potential for ensuring compatibility between universal and specialized technologies. The government's own test of public sector websites and ICT-based systems shows that, so far, the majority of systems do not have accessibility as a standard, which means that there is a huge gap, which needs to be covered. One explanation could be a lack of knowledge among the public vendors of *how* to implement the standards and the guidelines WCAG level AA from

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[22] Mette Schiøtz Sørensen (Interview 2007).

[23] Mette Schiøtz Sørensen (Interview 2007).

W3C[24] as, the guidelines often are difficult to interpret, mutually conflicting or in some areas outdated.[25] Therefore, KIA has developed a web-based toolbox for IT-systems and – equipment supply, which are available to public authorities. The toolbox should give guidance to public authorities on how to improve accessibility for people with disabilities. However, as we will see further on in this chapter, not everybody approves of the possibilities of open design and universal design. Alternatives include the initiatives for improving accessibility in the technology by increasing awareness regarding the equal access perspective, e.g. by the benchmarking of public websites and other ICT-based systems based on accessibility criteria, which was initiated due to criticism from especially the Centre of Equal Opportunities. [26]

The Danish NGOs

The Danish NGOs are related to both the Government, the public actors and the industry within the field of disability and they have had great influence on the general development of disability policy in Denmark. This shows the ability in Denmark to combine top-down and bottom-up perspectives in innovation of technologies and processes. These processes mainly take place within the Central Disability Council, which contains representatives from both disability organisations, individually and jointly within DH and the relevant ministries as well as representatives from public organisations such as the Centre for Equal Opportunities. The Central Disability Council plays a crucial role as the broker and communicator of a general disability perspective, a role, which is defined by the double purpose of being an advisory body to the public authorities as well as acting as a watchdog on the rules, laws and practices on behalf of people with disabilities. In effect, this means that different initiatives relating to overall government strategies are regularly coordinated, and the disability perspective increasingly implemented into general policies instead of being treated separately[27]. As such, the Central Disability Council seems to be an effective means for initiating and integrating state disability politics.

The public organisations, however, have been less directly involved in the current innovations on employment and ICT, while the private interest organisations have played by far the largest role. One possible conclusion is that the public interest organisations seem more interested in overall rights-oriented issues, whereas the user-driven organisations are more interested in issues with a more direct influence on the everyday lives of their members. In this way, the disability interest organisations are involved in policy-making process as well as having a direct involvement in innovative initiatives independently. Once again, this is evident in relation to the development of 'Dictus', where they played the dual role

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[24] WCAG (Web Content Accessibility Guidelines) deals with guidelines for the content of the Internet's accessibility for disabilities. The guidelines of WCAG are made by WAI (Web Accessibility Initiative). WAI is a subgroup under W3C (World Wide Web Consortium), which specifically deals with accessibility. See also http://www.w3.org/WAI/. (reference).

[25] Ministeriet for Videnskab, Teknologi og Udvikling (2006): "Kortlægning af IT-tilgængeligheden i Danmark". (Mapping the IT-accessibility in Denmark).

[26] Brinkman (Interview 2003)

[27] Monica Løland (Interview 2007)

of the driving force behind innovation as well as participating in the actual development. This is, however, far from the only project in which DH or its member organisations have been involved. Another clear example is the development of an optional registration scheme for companies in order to develop a useful tool for employers and employees in establishing whether their workplace is accessible for all, for example in regard to IT platforms. As such, the Danish NGOs help the industry and the small producers with the development and the adjustment of new assistive technologies by connecting them with future users of the technology.

Research institutions

Research institutions, especially Aarhus University and the IT University of Copenhagen, play an important role in innovation of ICT. It can be argued that universities increasingly contribute to process innovations because of their growing engagement in broad networks and partnerships between universities and other private/public partners, with the aim of mutual benefit concerning technological innovations and/or financial benefits. As such, the institutions are mostly related to the industry/ the small innovative producers as the research institutions often assist the latter in the development of assistive technologies in a partnership, which is often initiated and guided by such consortia as The Alexandra Institute. This new constellation in itself can be characterized as a process innovation, although, whilst a recent trend in Denmark, such relationships have existed for quite some time in many countries. There are two reasons for this development: Firstly, the mutual benefit potential specifically related to ICT-based development is unique due to the importance of creativity, insight into the user-perspective and resource investments. Secondly, because research institutions, as part of a broader development of the Danish and international research policy area, tend to function as private actors on market terms, which means they are also interested in benefiting financially from their innovations. This development has been, at least in Denmark, a major impetus for universities to engage increasingly in setting up creative environments consisting of several public and private partners with entrepreneurship as the main goal. Therefore, the research institutions' relation to the Government mainly concerns the financing of research, which takes place through funds and research programs.

Production and supply

As mentioned the field of production mostly consists of many small and middle-sized suppliers and small innovative private companies apart from a few larger suppliers. Among the latter, Microsoft especially plays an important role because of their agreement with the NITA about supporting interoperability between WS-Federation and SAML 2.0 based products, which is the chosen standard for the Danish public sector. Smaller specialized suppliers too are very dependent on the collaboration from Microsoft for ensuring the interoperability of specialized assistive technologies to the universal technologies. Besides this arrangement, there is not much cooperation between the larger suppliers and the small producers/suppliers because the latter are too small to be economical interesting for the

former. If the product is specialised IT however, cooperation could happen and the possibility of cooperation increases with the size of the small company. Between the smaller companies, there is generally much cooperation, for example about export, exhibitions and development. There is of course also competition since it is a small market with many actors.

However, the division between universal and specialized IT suppliers is currently becoming more blurred: Specialized assistive technologies are increasingly becoming more generalized in design as well as in utilization. A great example of this are the digital reading/writing compensating tools, developed with dyslexic people in mind. Today these are sold to schools on a large scale and are not only employed for children with dyslexia, but as a general tool assisting children in acquiring reading and writing skills. This mainstreaming of a specialized assistive technology has no doubt led to an improvement of the programme, as the pressure for quality is greater due to the broadening target group. Many municipalities all over Denmark have already invested in this, which has speeded the development up considerably. Thinking along similar lines, one can envisage an untapped potential for adapting specialized assistive technologies to more general purposes. A conceivable example could be whether tools for operating computers, originally developed for functionally disabled persons, have the potential to complement universal operation tools for the broader range of people suffering from so-called mouse injuries or for the prevention of these injuries. At the same time, a similar development but in the opposite direction takes place as universal IT suppliers on a global scale increasingly implement assistive technologies within universal technologies, such as the functioning of predictive writing in OpenOffice, the additional choices for the visually impaired in Windows, etc.

The convergence of universalised and specialized technologies is also relevant when considering the issue of 'open standards', which nevertheless did not contain special recommendations regarding accessibility for disabled people, despite the fact that this has a great potential for ensuring the compatibility between universal and specialized technologies. It would seem that the financial considerations rank higher than the accessibility considerations.

It is often argued that there is an antagonistic relationship between developing technologies as fast as possible and making the digitalisation of the public administration accessible for everyone.[28] Moreover, as the government's own test of public sector websites and ICT-based systems shows, the majority of systems do not have accessibility as a standard; the question is, whether it pays off to commit further resources to be innovative regarding the digitalisation of the public administration? Is it worth investing large sums in making existing systems accessible if, at the same time, one runs the risk of excluding a large group of people from jobs they currently perform, or would otherwise be qualified to apply for.

The open standards seem to be a natural counterweight to the difficulty of obtaining information from universal ICT suppliers, who due to their fear of violations of their copyrights, design inflexible specialized assistive technologies which lack compatibility with universal ICT tools. The disability organisations (DH) are very concerned about these problems. The previously mentioned digital reading/writing compensation programme serves as a great example, as it only functions with the most recent additions of Microsoft

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[28] Kim Brinkman (Interview 2003).

Word, thus imposing very high and specific demands to private users. It shall be interesting to see how the recent EU-verdict on Microsoft concerning its copyrights will influence further development of ICT especially with regard to specialized assistive technology and their compatibility with universal ICT tools.

Funding of new products

Another aspect is the question about the financing of the development and production of new technology. As mentioned earlier, new projects often take the form of partnerships involving a wide range of actors who all contribute with resources. In Denmark, there is not a fixed fund for development of specialized assistive technology because the Government claims this would make the system too rigid.[29] The argument being that if there is too much money then would they have to finance all projects regardless of quality and demands? Alternatively, what if there is not enough money in the funds?[30] These are certainly good arguments, however the present state of affairs often results in a need to use more time in order to handle cases, as well as insecurity concerning the future of a project. This already protracted state of affairs may mean that the addition of accessibility can only be realized with a time delay. This is certainly a disadvantage of the sector responsibility. If NITA is to approve a new project they stress that the product must be able to be used in not only a national context but also internationally and that, in addition, it can be used by people other than those with disabilities, for example elderly people, by means of which it finds a much broader target group. This is also something the producers should keep in mind when promoting the product to the firms.[31]

Producers, suppliers and the jobcentres

The producers have to sell their products to the jobcentres who have the overall responsibility for granting aids to people with disabilities and implementing assistive technologies within the labour market. This is a new configuration and we do not have much information on how the relations between the actors are. However, it is possible that there are difficulties and that the work relation between the producers and the jobcentres is not fully optimised. The municipal reform has made great changes resulting in new working procedures and tasks and there is much insecurity all the way round. Formerly, the counties were responsible for granting aids to people with disabilities and had many small special units with expertise. This expertise has now been gathered in the jobcentres. Many within the field of disability fear that knowledge will be lost and that there will be a decrease in the diffusion of knowledge. One can easily imagine that the producers and suppliers who had built up relations with the employees in the small units of the counties, must establish relations with the officials at the jobcentres. Furthermore, the reform has also resulted in much more focus on economic questions, which has increased the competition between the different producers and suppliers and made it more difficult to survive for the compa-

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[29] Mette Schiøtz Sørensen (Interview 2007)

[30] Mette Schiøtz Sørensen (Interview 2007).

[31] Mette Schiøtz Sørensen (Interview 2007).

nies. However, this could result in worse conditions for the users also, since the producers and suppliers have to compete based on price and not on the quality of their products. In their eagerness to save money, the municipalities focus on quantities and not on qualities.[32]

Open design and universal design – not the solution to everything

Not everybody approves of universal design and open universal software, a least not as the solution to all the problems within the field of ICT, disability and employment. One of our informants points out that it is not always for the best to gather everything. Of course, it is important to improve the general access within ICT for disabled people, but there is a risk of losing the individual perspective. It might result in the neglect of individual demands in favour of standard products that are not necessarily bad, but which nevertheless do not fulfil the specific demands.

Distribution and implementation

In this part of the section, we focus on the accessibility to and the utilization of ICT and on how the different actors interact in getting or keeping disabled people into employment.

Knowledge of disability and available ICT

One of the main characteristics of the relations between distribution and implementation is the lack of knowledge about disability in relation to employment and the available compensation schemes and assistive technologies. Many employers do not know what it means to have a disabled person with the firm or which assignments the disabled person can manage, especially if he/she has a visual handicap. Furthermore, they do not know about the available assistive technologies and the many possibilities within ICT and they do not know about the possibilities of economic compensation. This results in taboos about disability and doubts of having a disabled person with the firm, because many employers consider it too expensive and/or too complicated to employ a disabled person. However, as one of our informants points out there are great regional differences when it comes to taboos. Employees are often more open to people with disabilities in the Metropolitan Region than in for example Western Jutland.[33]

Of course, it is not realistic that every employer should know everything about the available products and the possibilities within ICT. What is important is that they know where to turn to get knowledge and guidance on the issue. Here the jobcentres play an important role as well, as exemplified by HMI, who disseminate knowledge about assistive technologies to both public authorities and private actors. However, many of our informants have pointed out that the knowledge and expertise about disability are excessively

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[32] Leif Lytken (interview 2007)

[33] Interview Børge Hansen 2007.

spread out so that there are too many places to apply. Perhaps the newly established Vidensnetværket (The Network of Knowledge) and the portal www.ijobnu.dk will improve the coordination of the diffusion of knowledge of disability and thereby increase the knowledge on the issue.

Use and implementation at the workplace

Another topic, which is very important when considering people with disabilities' access to employment by the use of ICT, is the knowledge of the disabled persons about ICT and their skills to use it. However, in Denmark most people with disability know where to turn for knowledge and guidance on ICT whereas their skills in using ICT may not be up to date. An introduction is demanded in order to gain the optimum use of the assistive technology. Due to the spread of expertise all over the country, there can often be a period of waiting before receiving the introduction. Moreover, the pace of the technological development may imply that specialized assistive technologies cannot keep up with the universal design because they cannot be adapted in time, thereby preventing the employee from fulfilling his/her job-assignments. Each development of a system requires tests and re-adaptation of the assistive technology, which also increases the above-mentioned waiting time for the expertise. It is a growing problem, which might result in the disabled person loosing his/her job, as he/her no longer can fulfil his/her tasks.[34]

Finally, one must also consider the economy both within each firm or public institution and more generally within the field. One could easily imagine even though it is possible to get financial support that employers especially those from the private sector would consider an investment in the necessary specialized assistive technology too expensive because the immediate use is only for one or few employees. It is therefore important that the employers be informed of the potentially broader use of the technology.

Jobcentres and their attitude toward the job seekers

It is one thing that the employers lack knowledge of the available ICT. It is, however, more disquieting that the jobcentres who are supposed to give guidance to the workplace or the employee on injuries, disability etc. often do not know about the available possibilities. Moreover, they may lack faith in the disabled persons' potential to function in the labour market. As mentioned, the jobcentres are a rather new organisation and while there is very limited knowledge on how they will function, speculation is abundant. Two concerns often brought up, are one, the maintenance of professional networks, and, two, preserving evenness in decisions regarding grants of assistive technologies. Another concern which has been raised relates to the effect of the relocation of persons with expertise in disability matters from the few units, where they were located before the reform, out to the 91 jobcentres. .

Job creation efforts are organized according to the status of the jobseeker: either the jobseeker belongs to the unemployment insurance fund (A-kasse) system (national authority), or to the public welfare (kontanthjælp) social assistance system (municipal authority). Nevertheless, the different services have the same physical location although this division

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[34] Børge Hansen (Interview 2007)

concerning organisation and funding has remained. We do not know whether this division creates differences in the service levels and waiting times experienced by jobseekers within the two systems.[35] It is known that before the 2003 transfer of the full sector responsibility to the public employment services (now Jobcentres), the municipal system required relatively long periods of time to process cases. There is fear among NGOs and jobseekers that the diffusion of the specialist expertise will create great differences between the jobcentres because some of the jobcentres are very small whereas the appointed officer might take part in the general jobcentre functions also, which means they are not handling cases related to people with disabilities only. This could result in reduced assistance to the disabled person and efficiency of the system regarding the allocation of support services, aids and the adjustment of the aids since the appointed officer has neither enough knowledge of disability nor of the available assistive technology. Furthermore if the jobcentre is small it might not have enough resources, neither human nor financial, to get people with disability into employment. As one of our informants says:

> It seems to me as if the jobcentre gives a lower priority to get people with disability into employment. When I turned to the jobcentre for a reduced-hour job, I was given the message that they did not have the resources to find such a job. It seems as if they only focus on the limitations instead of focusing at the possibilities. That is why I applied to a private consultancy in the summer of 2007 and now I have a job.

Thus, many within this field have the opinion that centralizing the expertise concerning ICT, disabilities, aids and employment and from there forwarding the knowledge to the regional centres would be a better solution than decentralizing. Nevertheless, an extensive reform as the aforementioned will always results in initial difficulties, as employees have been moved around and areas have been united. This will perchance be improved when the reform is well settled and perhaps the new secretariat, The Knowledge Network, will enhance the knowledge of the employees at the jobcentres.

Obstacles influencing access to and utilization of ICT

In this section, various issues in relation to the obstacles and potential sub-optimalities influencing the access to and utilization of ICT shall be mentioned.

The voluntary approach and the complications induced by technological development

Who has the overall responsibility in a world of networking? Even though this paper has discovered a rich organisation of networks with a broad range of participants, a critical perspective on this formation needs to be further explored. Since no institution or association is appointed to or has itself taken on the task of coordinating the efforts towards improving the employment situation of people with disabilities through the utilization of

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[35] Ibid.

assistive technologies, there is a risk of essential knowledge not being disseminated to the relevant actors within reasonable time frame if at all.

The VISO and the Specialist Centre on Employment & Disability are perhaps the institutions most closely engaged in such efforts, which raises the question if more could be done to coordinate the efforts of the innovative environments to production and distribution? The inclusion and exclusion of formal or informal networks seem to be the basic regulating principle regarding the dissemination of knowledge. This probably leads to sub-optimalities either on the part of the companies, finding it hard to read the market for investment potential, or on the other hand distributors and users, having to invest great time and effort in finding the right solutions. The new initiative, Vidensnetværket, could have the effect of resolving the lack of coordination by disseminating knowledge from both formal and informal networks since it is based on the knowledge of DH and its member organisations.

The case of 'Dictus', the Danish speech recognition, provides contradictory evidence to the argument of inefficiency in the link between production and distribution, as it took about 9 months from the moment it was presented to the public till it was granted to the first users for work purposes. This effort was however mainly due to the high involvement of disability organisations, which could suggest that formal constellations with joint user and production involvement, similar to the composition of the Central Disability Council, could be a great improvement to this specific area.

The Danish system in general approaches disability issues with a mainly voluntary approach and if the development is guided, it is done through public investments rather than regulations. For many purposes, this seems to work well, but with the merging of specialized and universal technology, it increasingly becomes a problem. This holds true especially in the case of assistive technologies needing adaptation to Danish circumstances (language or tradition), but also the development of innovative add-ons for the purpose of greater utility, for example in regard to the large universal companies' protectiveness towards their products and traditional stand on copyright issues. This means that accessibility often suffers from a time delay, so that people with disabilities cannot utilize the new inventions to the same degree as non-disabled people. An example is pdf-files, which the speech-recognition programme was capable of reading, but when pdf files are saved as pictures as is often the case, the programme is unable to read the files.[36] Visually disabled are stuck and at worst, could lose their job as a result. Summing up, the problem seems to be an example of the sector responsibility not being taken seriously within this field.

The duality of sector responsibility

The principle of sector responsibility, which dominates the Danish practice with regard to providing equal access for people with disabilities, includes a duality, which filters through to the practice. On one hand, it ensures that all decisions in relation to equal access start with the premise of the labour market rather than disability, which is generally accepted to improve the quality of services for not only people with disabilities, but also their employers.[37] On the other hand, the sector responsibility involves a high devolution of responsi-

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[36] Børge Hansen (Interview 2007)

[37] Inger Kirk Jordansen (Interview 2007) & Leif Scherrebeck (Interview 2007)

bility, which increasingly becomes a problem with the rigorous cost control, which current public policies are promoting, as well as the fact of the large degree of convergence between universal and specialized technologies causing problems. More specifically, the problem occurs when assistive technologies are useful for a variety of purposes in everyday life, for health purposes, for work purposes, etc., and thus can be granted based on several legal paragraphs involving several different actors. In this way, the question of ensuring that people with disabilities are compensated according to their needs is complicated by the question of who should pay. Though there has been established a cross-ministry committee, which debates the division of responsibility among the different ministries it is likely that there are users, both employees and employers, who are trapped in the system because it is not all clear who has the responsibility.

To sum up the point, assistive technologies are increasingly challenging the existing system, because they serve multiple purposes, and because the responsibility for compensating people with disabilities in relation to labour is not clear, which again relates to the previously mentioned issues raised by the voluntary approach.

Parallel systems

Following the previous line of argument, another problem concerning sector responsibility is worth mentioning: When the main responsibility is divided between several actors, and maybe also partly because attention to the access of persons with disabilities to the labour market only became an issue in Denmark rather late, several lines of service systems with similar aims serving similar fields exist. Examples include the jobcentres, who are responsible for the granting of assistive technology for work purposes, and the local centres for assistive technology, which are responsible for the granting of assistive technologies for the daily life purposes. Considering the general tendency of convergence between universal and specialized technologies as well as the technological developments of pervasive computing, it is likely that these two lines of service systems (the job centres and the local centres for assistive technology) have shared interests. In Denmark, examples exist wherein these two different bodies have workshops located at addresses next to each other, where people could get information on and guidance to the assistive technologies suitable for their needs. They can even see and try the aids in a realistic environment, so they are informed about the realistic possibilities and their implications for an individual's working capacity or capacities concerning everyday life tasks.

The solutions to these problems are not easy ones, because the principle of sector responsibility without a doubt prioritises sector perspectives higher than general disability perspectives. As argued above however, sector responsibility also proves problematic in ensuring both that a high degree of relevant knowledge is disseminated to all involved actors as well as ensuring a clear distribution of the responsibility for compensating all potential users according to their potential.

The dilemma of compensation

The seemingly infinite opportunities, which the technological development offers for the development of assistive technology, paradoxically involve a great dilemma regarding the extent to which people with disabilities should be compensated and the extent to which

the government should assist people with disabilities by supporting the acquisition of skills and self-confidence and familiarity with assistive technologies.

This is of course something that should be decided politically, but is nevertheless an issue that should be raised as it relates to the discussion of the inclusion of people with disabilities into society, as well the question of the status of inclusion within the labour market as more than merely an economic matter. In Denmark, the decision has so far mainly been discussed in terms of finance rather than rights.

An interesting question is the rather theoretical question of whether there is proportionality between compensation and functionality in the labour market. Inger Kirk Jordansen from HMI[38] pointed out that she has experienced situations where the assistive technology seems to be less of an obstacle than the social competences required for a person to be able function in a job. This again highlights the role of education and the difficulty of transition to the labour market for people with disabilities, as well as the limitations of assistive technology. Disability is not just a question of function. The disabled person is also marked by his/her past: The one who grows up with a disability learns to function differently than the one growing up without a disability. The one who has a disability could respond strongly to growing up with a disability.

Organisational dynamics

As mentioned in part two ICT embrace both innovation of technologies and innovation of processes and services. Both perspectives will be important for the balance in the firm. The firm is an organisation and an organisation does not have a foregone structure, though its formal structure seeks to give that impression. In reality, the structure is something, which is maintained through daily interactions. Having a disabled person with the firm implies new and different interactions and processes. This can challenge, potentially change, the balance of power, leading possibly to conflicts. A change in the balance of power may be desired by some and not desired by others. The range of choices within the firm may be restricted as, for example, the need to consider the disabled person when purchasing new ICT-based systems or planning alterations. In addition, it may also affect the employees' mutual control systems because they might not know how to respond to the person and what to expect from the disabled person. As such, there are often many taboos both within the management and among the employees about the disabled person, which can cause conflicts. The disabled person's presence in itself may have an importance as well as requiring adjustments and systems. With aids, the number of possible conflicts and the number of employees these conflicts possibly involve may increase. Thus, more flexibility is often emphasized as desired within the firms and both the management of the firms and the jobcentres play an important role regarding this.

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[38] Interview 2007

Barriers within the system

In this section, we will sum up, in 15 points, the main barriers in the different phases, which have been identified in this paper. We have added a drawing of the job seekers' different paths through the system into employment and to the available assistive technology, where we try to describe the different barriers within the system.

Innovation and production

Sector responsibility – who has the responsibility?
Lack of coordination of communication and knowledge
Limited financial resources
Producers' dependency on public funding because of the small market

Production and distribution

Lack of coordination of communication and knowledge
Size of the potential market
The merging of specialized and universal technology resulting in multiple purpose of ICT
– thus who should pay
Cooperation with the jobcentres

Distribution and Implementation

Sector responsibility – which actors have the responsibility?
Long case-handling time
Lack of coordination of communication and knowledge
The approach of the jobcentres toward people with disability

Implementation and use

Lack of coordination of communication and knowledge
Incompatibility between the specialized and universal design
Education in the use of ICT

Map over the job seeker's path into employment

Here is a rough drawing of the job seekers path through the system into employment and to the available assistive technology. A space between arrows and a box signifies a potential barrier.

Figure
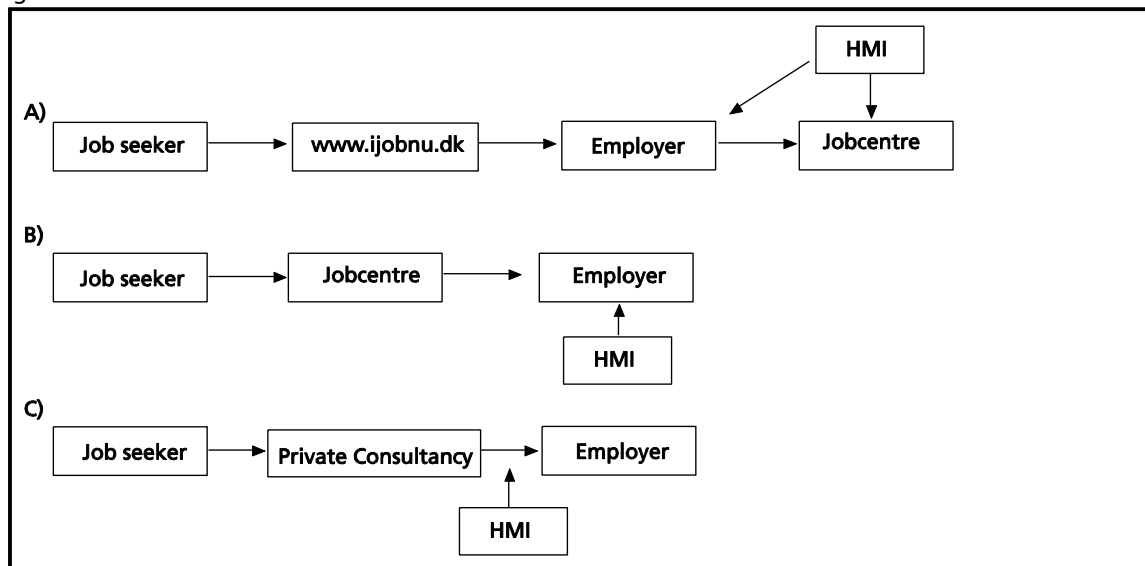
Conclusion

In this paper, we have investigated the Danish system of innovation, production, distribution and implementation of ICT-based assistive technology for people with disabilities; that is, we have mapped the relevant actors, their tasks and with whom they cooperate within the system. In the field of innovation, the most important actors are the Government, the Danish NGOs, small innovative producers and the research institutions. The Government is responsible for the policy and regulations within in the field, and financial support and initiatives that have to do with the public sector. As such, Government has introduced *open standards* in all public sector digital projects in order to ensure the accessibility of people with disability in public workplaces. The tasks of NGOs concern, among others, putting focus on the demand for new assistive technologies and as well as on regulations, and supporting projects both financially and with knowledge. The small producers locate or develop/adjust assistive technologies according to the needs of the disabled. Finally, the research institutions furnish technological and expert knowledge.

Within the field of production and supply, we find the universal and specialized IT-suppliers, the private/public consortia and DRG – the Danish Rehab Group. The larger IT-suppliers are important because their use of specialized assistive technologies depends on the technologies' interoperability in relation to universal technologies. Therefore, the willingness of these suppliers to cooperate with governmental and private partners is essential. The small-specialized IT suppliers develop assistive technologies, and supply people with disabilities with these technologies for job purposes. The consortia often provide the necessary investments so that the technology can be produced and marketed and/or bridge the private-public gap and promote cooperation between private companies, other organisations and public research units. DRG helps producers with the marketing of their products both nationally and internationally.

Within the field of distribution, we find different public actors who are responsible for implementing regulations and initiatives and for disseminating knowledge about disability all with the goal of increasing the number of employed disabled people. The key actors are the jobcentres, run by the municipalities in cooperation with the Ministry of Employment, who have the overall responsibility for helping people with disability into employment. We also find private consultancies that play an increasing role in getting disabled people into employment. As such, they are a supplement to the jobcentres and often assist the jobcentres.

Finally, within the field of implementation we find many different actors such as the people with disabilities, the employers, the aids, the portal www.ijobnu.dk, regulations and the public actors who are responsible for the dissemination of knowledge about disability, ICT and employment.

The overall picture of the Danish system is that it is generally characterised by a great reciprocity between the different actors and many of those are active in more than one of the fields, which is certainly the case with regard to the fields of innovation and of production. As such, there is much cooperation between the Government, the NGOs and the

producers as regards the development of assistive technologies. They meet regularly to discuss the Danish system of disability in general, and more particularly which initiatives are to be undertaken to improve the situation for people with disabilities. Particularly the NGOs cooperate with both the national and the local authorities about policy, regulations and distribution of knowledge about disability and act as a watchdog on the rules, laws and practices on behalf of people with disabilities. The NGOs therefore seem to be an effective means for initiating and integrating state disability politics. The research institutions are mostly related to the industry/ the small innovative producers as the former often assist the latter in the development of assistive technologies- These partnerships, are frequently initiated and guided by the private/ public consortia such as The Alexandra Institute.

There are however also difficulties within the system concerning different aspects. Firstly, the Danish system, in general, approaches disability issues on a mainly voluntary basis with the result that guiding development is done through public investments rather than regulations. This seems to work well in many cases, but with the merging of specialized and universal technology, it increasingly becomes a problem. One can think of assistive technologies needing adaptation to Danish circumstances or the development of innovative add-ons for the purpose of greater utility, for example in regard to the large universal companies' protectiveness towards their products and traditional stand on copyright issues. Accessibility is therefore often added with a time delay leaving people with disabilities unable to utilize the new inventions to the same degree as non -disabled people.

Secondly, there is the principle of sector responsibility that dominates the Danish practice as regards providing equal access for people with disabilities. This principle on the one hand ensures that all decisions in relation to equal access start with the premise of the labour market rather than disability, which is generally accepted to improve the quality of services for not only people with disabilities, but also their employers. On the other hand, the principle involves a high devolution of responsibility, which increasingly becomes a problem with the rigorous cost controls that current public policies are promoting, as well as the fact of the large degree of convergence between universal and specialized technologies. This may cause long case-handling times resulting in time delays for new projects.

Thirdly, the newly municipal reform has made great structural changes such as decentralisation of specialist expertise resulting in new procedures and tasks for the jobcentres, which has created great insecurity within the field. As such, NGOs and jobseekers fear that the diffusion of the specialist expertise will create great differences between the jobcentres resulting in reduced assistance to the disabled person regarding allocation of support services, aids and adjustment of the aids. Moreover, one of our informants experienced that a jobcentre lacked faith in his potential to function in the labour market.

Fourthly, there is the question about the adaptation of the specialized assistive technologies to the universal. Both the national authorities as well as the small producers are dependent on the collaboration from the larger IT suppliers such as Microsoft for ensuring the interoperability between specialized and universal technologies. However, the division between universal and specialized IT suppliers has become more blurred: Specialized assistive technologies are increasingly becoming more generalized in design as well as utilization. For instance, digital reading/writing compensating tools today are sold to schools as a general tool assisting children in general and not only children with dyslexia in acquiring reading and writing skills. The convergence of universalised and specialized technolo-

gies is also relevant when considering the issue of 'open standards', which despite the fact that this has a great potential for ensuring the compatibility between universal and specialized technologies nevertheless did not contain special recommendations regarding accessibility for disabled people. The government's own test of public sector websites and ICT-based systems however, shows that by far the majority of systems do not have accessibility as a standard, which means that there is a huge gap, which needs to be covered. This may be due to a lack of knowledge among the public vendors regarding *how* to implement the standards. The open standards however, seem a natural extension of the broad and highly differentiated development of ICT in order to counter the difficulty of obtaining information from universal ICT suppliers due to their fear of their copyrights being violated, which often results in inflexible specialized assistive technologies in terms of compatibility with universal ICT tools.

Finally, there is the lack of diffusion of knowledge, which may be caused the voluntary approach and a rich organisation of networks with a broad range of participants. This means that no institution or association is appointed to or has itself taken on the task of coordinating the efforts towards improving the employment situation of people with disabilities through the utilization of assistive technologies. This lack of coordination gives rise to the risk that essential knowledge may not be disseminated to the relevant actors within reasonable a time – frame, if at all. As many of our informants have pointed out, knowledge and expertise are so excessively spread out that is there are too many places to apply for information. The new initiatives Vidensnetværket and the portal www.ijobnu.dk might diminish these difficulties, though there are complications within the Danish system, which leave much to be done to improve it.

List of abbreviations

AMS   The Labour Market Administration
CLH   The Centre of Equal Opportunities (secretariat of DCH)
DCH   The Central Disability Council
DRG   The Danish Rehab Group (producers)
DH   The Danish Council of Organisations of Disabled People (from 2008)
DH   The Danish Council of Organisations of Disabled People (to 2007)
ICT   Information and communication technology
HanDiaTek Network of Disability, Dialogue and Technology at Aalborg University
HIT   A Review edited by HMI on IT in assistive technology
HMI   The Centre of Assistive Technology
KIA   The Competence Centre ICT for All
MSTD   The Ministry of Science, Technology and Development
NITA   The National IT and Tele Agency
OIO   A Catalogue of Public ICT Standards
SAML   Security Assertion Markup Language
SFI   The Danish National Institute of Social Research
SPS   Special Needs Support (part of SU *)
SU   General State Support for Students
TDC   Tele Denmark Corporation
VISO   The National Expert Support for Public Authorities
WAI   Web Accessibility Initiative
WCAG   Web Content Accessibility Guidelines
WS   Web Services
W3C   World Wide Web Consortium

(*) As most students need to work 10-20 hours a week to supplement the general state support for students (SU), students with disabilities are given the double amount to compensate for their lack of working ability.

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http://www.hmi.dk
The Alexandra Institute
http://www.alexandra.dk

DCH – The Central Disability Council (Det Centrale Handicapråd): http://www.dch.dk

DRG – The Danish Rehab Group (Dansk Rehab Gruppe) http://www.drg.dk

DH – the Co-operating Disability Organisations (De samvirkende Invalideorganisationer) http://www.handicap.dk

eInclusion@EU http://www.einclusion-eu.org/

KIA, The Competence Centre ICT for All (Kompetencecenteret IT for Alle): http://www.oio.dk/tilgaengelighed/kia

http://www.oio.dk/tilgaengelighed/kortlaegning07

MSTD (The Ministry of Science, Technology and Development – Ministeriet for Videnskab,Teknologi og Udvikling): http://www.videnskabsministeriet.dk

OIO(Public Information Online) http://www.oio.dk

SPS (Special Needs Support) http://www.spsu.dk

The Network of Knowledge (Vidensnetværket) http://www.vidensnetvaerket.dk

Interviews (most of them conducted 2007)

Mette Raun, consultant on labour market policy, DH.

Monica Løland, consultant on accessibility of ICT, DH.

Inger Kirk Jordansen, consultant & occupational therapist, HMI.

Leif Scherrebeck, Specialfunktionen Jobcenter Vejle.

Mette Schiøtz Sørensen, consultant in the National IT- and Tele Agency (NITA)

Kim Brinkmann, consultant in the National IT- and Tele Agency (NITA) (2003)

Børge Hansen, visually disabled.

Leif Lytken, director of Danish Rehab Group

Chapter 2. The Netherlands

By: Femke Reijenga, Freek Lötters, Jannet van Egmond

The first research step in "ICT, disability and employment" was to get a general overview of the national ICT strategy, and a specific overview of disabled people in the four countries involved in this project (Norway, UK, Denmark and the Netherlands). The second step in the project is focused on the innovation processes of ICT for people with disabilities in the specific countries. In the Netherlands the research is concentrated on people with visual impairments.

In the Netherlands we identified the stakeholders involved in the distribution and use of ICT and the employment of people with visual impairments, checked recent publications and we interviewed representatives of the most important stakeholders.

In this paper we will answer the following questions:

1. Who are taking part in the diffusion system in the Netherlands?
2. What characterises the (system of) cooperation between these actors?
3. What characterises the role of national or local authorities?
4. How do non-public actors in the diffusion system assess the role of pubic authorities?
5. How do producers of ICT adapt to the demand for universal design?
6. What barriers/bottlenecks for the innovation process can we identify?

In addition, we will add some information on the employment of people with disabilities in the Dutch context in general and we will formulate some recommendations for the third step in the project *ICT, disabled and employment*.

The target group

Good statistics on the prevalence of visual impairments in the Netherlands are missing (Limburg, 2007). According to most recent studies (CBS, NIVEL, SCP and Limburg, all 2007) between 200.000 and 300.000 persons have severe visual impairments. Most of them – 85 % - are older than 65 years: roughly we can say that about 30.000 persons in the working age population have severe visual impairments (about half of them being blind). Some of them have other (severe) impairments or intellectual disabilities as well and are not able to work at all. Estimations of the percentage of people with severe visual impairments active in work differ (depending on the definitions). Some statistics, like those of the Social Cultural Plan Bureau (SCP) and Central Bureau for Statistics (CBS) show that about 55 % of persons with visual impairments are active on the labour market. This participation rate is higher than the participation rate of persons with mobility or hearing impairments (47 and 52%, see table below). Other statistics, like those of the NIVEL say that 30 % of the people with severe visual impairments (about 9.000) are actually working. Presumably the numbers differ because of the different definitions.

Table 4.5

Tabel 4.5
Nettoarbeidsparticipatie[a] van mensen[b] met motorische-, gezichts- en gehoorbeperkingen,[c] naar achtergrondkenmerken, 15-64-jarigen, 2003 (in procenten)

	motorische beperkingen	gehoorbeperkingen	gezichtsbeperkingen
totaal	47	52	55
mannen	57	66	68
vrouwen	41	36	43
15-34 jaar	59	74	63
35-44 jaar	59	67	70
45-54 jaar	54	58	64
55-64 jaar	25	30	28
basisonderwijs	28	41	34
laag opleidingsniveau	46	55	55
middelbaar opleidingsniveau	56	58	61
hoog opleidingsniveau	62	60	67

Source: CBS statline: labour participation of people with physical (motorische beperkingen), hearing (gehoorbeperkingen) and visual impairments (gezichtsbeperkingen): gender, age and education level (from basic to high education level).

All sources expect that the number of people with visual impairments in the working age population will grow very fast: the workforce is getting older and above the age of 50 the prevalence of visual impairments rises very fast. In addition the prevalence of visual impairments is growing due to the development of the overweight problem in our Western society: overweight leads to the risk of getting type II diabetes which gives a risk of visual impairments. Researchers (like Limburg, 2007) expect that the rapid developments in specialised eye care and surgery could compensate in some ways for the growing number of people with visual impairments.

Generally speaking, the education level of people with visual impairments is quite high (compared to people with other disabilities). According to the Association for the Blind (Viziris) the labour participation for people with visual impairment is changing. Traditional work as masseur, telephonist, typewriter or receptionist is disappearing, although new office work (in the ICT, for call centres or in radio screening for the police) is on the rise. For the lesser educated, there are still some jobs in the supported employment sector (sheltered workplaces). For the higher educated persons with visual impairments it is comparatively easy to find a job, like in science and music. The exact number of job seeking persons with visual impairments is not recorded, but will be far less than 9.000.

Viziris is of the opinion that the labour market is not improving. Potentially there are jobs, especially due to developments in digital technology (so ICT is offering new chances for people with visual impairments), but on the other hand they see that the growing expectations of a high productivity and high work pace put a heavy load on the shoulders of people with visual impairments. Members of Viziris state that the solidarity among co-workers is getting lower due to cost efficiency driven management. More than in the past people with visual impairments – partly or completely able to work – nowadays fear they cannot cope with the high demands of working life. The number of labour participants indicates otherwise, but this is what Virziris hears from members most often.

FAMA, a large return-to-work service provider (specialised in services for people with hearing or visual impairments) claims to find matching jobs for about 50 % of the persons with visual impairments who make use of their services (Estimated: about 80 % of the target group that comes through the social security agency (UWV) is sent to FAMA for a return-to-work program (called :"traject" or route). As the most important barrier ton finding and keeping a job, FAMA points to the consumption of energy which the person must expend outside of work. . For a person with a visual impairment getting ready to go to work and the use of transport to work costs a lot of energy and time, so quite a few of them are tired the moment they start their working day. Being at work they face other problems, like a lack of communication, lack of support from co-workers, no helpdesk for specific problems with the work or the non-compatibility of computer systems. The project from iRv "Maintaining a job for people with visual impairments" reports these barriers as well.

The actors involved in the innovation process of ICT for the target group

We identified eight kinds of actors in the innovation process of ICT for the target group in the Dutch context. We exclude the producers of ICT, because they (Microsoft, Apple, IBM, etc) operate on international level. The Norwegian research partners will interview these producers and will investigate their role in ICT developments in several countries.

In this chapter we will give some general information on the actors.

1. People with visual impairments themselves
2. NGO's (specific and general)
3. Education and rehabilitation institutes (including Expertise centres)
4. Return-to-Work Service Providers
5. Distribution market for ICT applications
6. Public provider of provisions and benefits (UWV)
7. Occupational health service Providers (for Employers)
8. Employers

Persons with visual impairments (1) looking for a (new) job are registered at the public Social Security Office (UWV) (6) and will get support from a Return-to-Work Service Provider (4). At this moment two Return-to-Work Service Providers are specialised in jobseekers with visual impairments: FAMA and Obol. FAMA is the largest and is coaching about 80 % of the persons with visual impairments to work. Obol is a small service provider, led by a well experienced blind professional.

The jobseekers will receive a regular or an individual return-to-work agreement that allows them to choose their own service provider. The ICT they need for their work could be ICT tools they already obtained during their education (or because they use it at home as well). Most persons with severe visual impairments are trained at special (regional) education centres like Sensis, Visio, Loo Erf, Sonneheerdt, Bartimeus and iRV. The centres were reorganised some years ago and some focus only on education and training or on living, others focus on care and personal support in society. The largest rehabilitation institutes are: Bartimeus/Sonneheerdt (a fusion) and iRv (3). The larger Rehab centres have their own departments for or specialists in ICT applications. Like the iRv in Hoensbroek: who run a expertise centre (Xidis) for ICT and Handicap. Xidis helps individual persons with selecting and using the right ICT tools for use in their daily life, in education and work. Most of the consulting is related to care, education and the daily life at home. The costs for the ICT tools and the consulting will – mostly – be paid with public insurance funds (see the report of the first research step) or by the private insurance of the person him/herself.

When a person with a visual impairment starts to work and needs special ICT tools for his/her work, UWV pays for those provisions. Employers could ask their Occupational Health Service Provider (OHSP: so called "arbodiensten' (7)) to advise them on adjust-

ments to the workplace and other specific requirements for their employees. Employers will obtain the provisions from UWV as well. For this limited study we didn't interview employers or the occupational health service providers.

For the distribution of specific ICT tools for people with visual impairments just one actor can be identified (5): Optilec. A few years ago a few distributors were active, Optilec is now the only player in the field. Optilec provides hardware and gives support in using hard- and software. They work on behalf of (or in cooperation with) the education and rehab centres, on behalf of individual clients, employers and occupational health service providers. Sometimes UWV requests Optilec to assist in specific applications. Optilec co-operates with the telecom companies as well.

There are many NGOs (2) in the Netherlands for people with disabilities in general (see the first part of the research project: for people with visual impairments and employment related issues the most important is the association or federation of persons with visual impairments, Viziris. They provide information about legislation and provisions, test and review new ICT tools. They work close together with the rehab centres and are familiar with the work of Optilec. Viziris has expertise in all sectors, including daily life issues, living, care, education, transport and work.

Some of the actors we interviewed suggested that we contact the Dutch Association of Optometrists as well. According to their website they focus on eye care and technological innovations in eye surgery. They're not working in the field of employment, so we decided not to include them in this study.

The roles of the actors and their relationships

We interviewed representatives of six actors: we spoke with two persons with visual impairments, two representatives of NGO's, two Rehab centres and one expertise centre part of a rehab centre, two Return-to-Work service providers and with one distribution company. The questions we asked them were formulated by the Norwegian research partners; so we used the open, semi –structured list of questions.

All representatives agree that most people with visual impairments and the professionals assisting them are familiar with each other. They all know the players in the field, who's consulting who and where to get the latest news on ICT. The persons with disabilities and their advocacy groups are eager and in need of ICT innovations. So finding persons to help testing new tools is very easy. They know where to get the right consultancy and know the professionals involved personally. This results in a small and closely related network in which the ICT innovations diffuse very quickly. Should Optilec produce a new ICT tool, the news will spread very quickly among large parts of the informal and formal network.

But a small, almost closed network can have a disadvantage as well: fewer challenges may lead to fewer innovations, or to less experimenting with something completely new. A large, open network could challenge the professionals to look more at different perspectives in their technological work.

Different actors (from diverse backgrounds) assist in workplace practice and none of the people we interviewed mentioned a competition in this market of consultancy and advice. There is a lot of cooperation and although there seems to be a monopoly position for Optilec, none of the spokesman seem to be worried about it. On the contrary: they appreciate the overview they have of the stakeholders involved. We found, as well, that reactions were positive regarding the position of the public provider of funding: UWV. Although UWV is very often seen as slow, bureaucratic and lacking flexibility, actors looking for ICT support for people with visual impairments state that UWV is very cooperative. Most of the ICT requirements needed on the workplace are paid for and there are no real complaints about the administration or the bureaucratic workings of UWV. This is a surprising finding if we look at the negative public image of UWV.

In figure 1 we show the network of actors in the ICT use and innovation for people with visual impairments. The network seems complex, but in the opinion of the people in the network it is very clear: they know exactly who's working where. An illustration: we made contact with FAMA and asked for a professional in the field of ICT. We received a mail address of a professional working for both FAMA and Bartimeus. Later we realised this person was working for Sonneheerdt and Viziris as well. So there are no strict boundaries between the actors. It doesn't look like a political field of actors, although the interests of the actors differ in theory and in practice.

Figure 1 Actors in ICT use at work for people with visual impairments
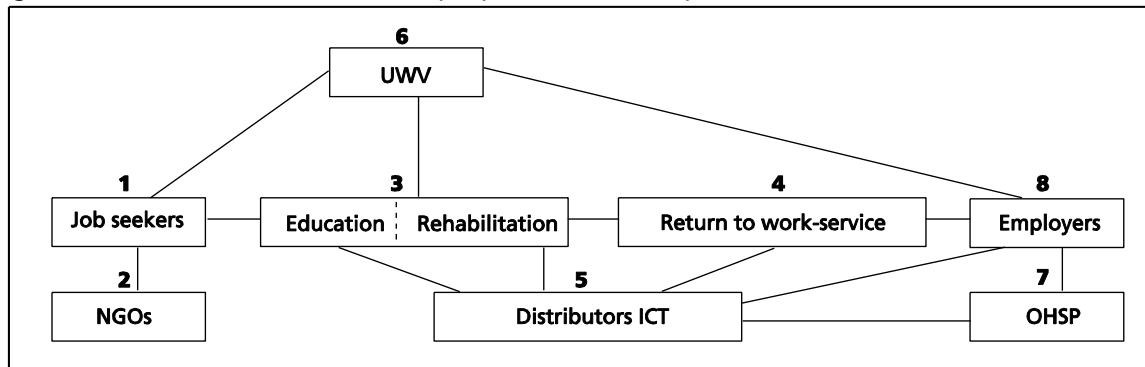
If we characterise the (system of) cooperation between these actors, this is what we find:

A mutual interest in innovation and agreement on the most important issues;

An eagerness to test and to use innovative ICT applications;

A compact, cooperative network (in which every one knows every one);

Recently many changes in the network: due to reduced public finances there is a clustering of more centralized Rehab expertise;

No transparent boundaries between the actors. For the outsider it's not easy to understand who's working where and doing what;

A monopoly position for the distribution of ICT (hardware) tools;

No obvious competition;

The feeling among the actors is that they do not exert much influence on the development of new ICT tools since most ICT comes from the large international producers.

Important ICT developments for the target group

Specific ICT

The stakeholders we interviewed agree on the most important ICT developments of the recent year.

They mention:

the synthetic speech ICT

the enlarged screens

the (Braille) screen readers.

Other general developments, which were helpful for people with visual impairments, include the networking on distance, MSN and other digital technologies. The users prefer US software because this software is accessible for people with visual impairments. They suppose this accessibility is caused by the clear anti-discrimination laws in the US.

Other innovations mentioned are the Braille printer (although not always working perfect), options for specific Windows XT adaptations, organisers and mobile phones with Braille in- and output.

With these digital developments some disadvantages come as well: working with the PC with the network on a distance (like Citrix) leads to problems regarding the lack of compatibility with local networks (like an internal network with the co workers at the workplace), less tailor-made solutions (inflexibility of the network) and the need for a helpdesk familiar with both "ends of the line".

But even more important are the consequences of the use of new ICT tools: people need to be trained in it adequately and (in working situations) co-workers, ICT supporters and employers need to have (basic) information about the consequences of the use of the ICT tools. When the ICT tools change (which is quite often, because ICT developments go fast) the users and their network has to learn to work with these novelties. Without information and communication on the use of new developments, ICT will not work.

Universal design

We asked the stakeholders if they see developments towards universal design (known in the Netherlands as Design for All). Some stakeholders have the idea that universal design is not well known in the Netherlands and is only developed abroad (UK or US). Others see only some universal designs in consumer products for daily life (washing machines, banking) but are not familiar with any work related universal designed products. The ICT experts from the Rehab centres have hopes that the global attention to Design for All is growing. They are of the opinion that society is – slowly – becoming more accessible and

more open to the needs of people with disabilities. Because of the small scale and the lack of a real R & D sector for ICT (for visual impairments) in the Netherlands, the actors do not expect fast developments in universal design within a few years. They see the Dutch as "followers" and not as "initiators" of ICT innovations.

Barriers and success factors in the use / innovation of ICT

We see, along with the experts we interviewed, various barriers and success factors in the use of ICT tools for the target group.

We start with the barriers:

- a lack of compatibility of ICT systems at the workplace; closed circuits of internal networks (for security reason) do not allow specific ICT tools for employees with visual impairments;
- a lack of personal assistance in the workplace (remote helpdesks not familiar with the conditions at the workplace itself);
- time lag in innovation: applications for people with visual impairments are always a few steps behind new – general technologies. So they will always be behind in developments;
- small scale demand: a small Dutch language market, so solutions are either expensive or in English (like the speech assistant in Windows XP);
- increased visualisation of society, reflected on Internet sites (according to some of the actors we interviewed);
- due to management focused on cost saving, Rehab centres and special schools have less money for education. This leads to shorter courses and smaller training programs in ICT. Some people with visual impairments (especially those with a lower education level in general) need more time for education in ICT, which results in fewer opportunities on the labour market.;
- in general there is criticism about the governmental policy in which health care and education for people with disabilities receive fewer subsidies, leading to less money for proper ICT courses;
- employers may have a negative image, due to a lack of information about their competencies, of persons with visual impairments. So employers are reluctant to invest in special ICT tools (or in administrative procedures to get public funding for these tools).

On the other hand the actors see positive elements in the ICT innovation processes as well.

Success factors:

- relatively high education level of persons with visual impairments: this enables them – more than other groups of people with disabilities - to make use of (new) ICT tools;
- the diffusion of new ICT tools will go very fast due to the small and strong network;
- ICT and the digital society is – in general – welcomed and not seen as a barrier for employment;

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- ICT gives – to those with a good education level – opportunities for new jobs;
- The role of the public authority (UWV) is seen as a positive one: tools are easily accepted, the development of some tools is subsidised as well;
- US software is seen as very helpful because this software is adapted to the needs of people with visual impairments.

The focus of this paper is on the role of ICT only for people with visual impairments. Because the scope of the project *ICT, disabled and employment* is broader, we also identified barriers for the role of ICT for other groups of people with disabilities.

The barriers we see for groups with other impairments are:
- less specific ICT applications, even smaller market;
- in general less eagerness to use new ICT by the persons themselves;
- more difficulties to get public funding (because of fragmented ICT market, less evidence of the added value of the required or available tools);
- more actors, less cooperation in the chain of demand-supply (but on the other hand more actors can give more competition and this can result in more innovation;
- splitting up of sectors and of expertise, leading to a fragmented and less transparent market of ICT distribution and development;
- the lack of an overall ICT policy strategy for people with disabilities in the Netherlands.

We didn't check if these supposed barriers actually exist in practice, and we didn't ask the stakeholders for feedback on these suppositions.

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Chapter 3. Norway

The Norwegian system of innovation and diffusion -actors and barriers

By Inger Lise Skog Hansen and Steinar Widding

Aim of the paper

The ambition of this paper is to examine what we have labelled *the Norwegian innovation and diffusion system concerning disabled peoples' access to ICT*. First, we map the relations between the actors within the system. Second, we seek to identify barriers in the system that restrain innovation of ICT that could contribute to increase participation of disabled people in working life and society, and, third, we seek to identify barriers for implementation and use of available ICT.

The main hypothesis is that the potential of ICT is not fully utilized as a potential for increased labour force participation of disabled people.

For the purpose of clarity we have chosen to separate the diffusion and innovation system into four different phases: Innovation, production, distribution and implementation. This paper is structured according to these four phases. In chapter two we describe the different actors involved in the system dependent on *where* in the system they operate. In chapter three we analyse the *relations* between these actors. In chapter four, we summarise the *barriers* in the system that have been identified through the interviews conducted.

Data

The analysis in the paper is based on sixteen qualitative interviews with different actors in the system: Producers, deliverers, governmental bodies, NAV at different levels, user-organizations, employers and employees. In addition, field research has been undertaken by participating in a seminar about innovation and assistive technology arranged by the Norwegian Work and Welfare Organisation (NAV) for producers/suppliers of assistive technology and employees at the Assistive Technology Centres. Information has also been collected through document analysis and through websites.

Actors in the Norwegian diffusion system

Innovation

Government

During the last years the Government has been intensifying the workfare policy to get more people outside the labour market into employment. This policy has recently been concentrated around the agreement for an Inclusive Working Life (Inkluderende Arbeidsliv, hereafter called IA). The first IA agreement was signed in 2001 by the Norwegian Government and the social partners[39] in the labour market. The agreement has three aims: to reduce sickness absence, to increase the recruitment of employees with impairments and to raise the age of retirement. To strengthen the workfare policy the government introduced a large organisational reform of the work and welfare organisations, establishing a new joint Norwegian Work and Welfare Organisation (NAV). From July 2006 the earlier National Insurance organisation and the National Employment organisation, and part of the municipal Social welfare organisation merged together in NAV.

The government has also become increasingly concerned about digital inclusion and accessibility. This includes regulations for official websites to follow the WAI criteria and initiatives to promote universal design of ICT. In addition, a proposal that all new ICT targeted towards the general public should be universal designed by 2011, and initiatives on open standards and open source, have been taken.

Non-Governmental Organisations (NGO)

There are several organisations of disabled people in Norway. In this study we have interviewed representatives from the Norwegian Association of disabled, which mainly organise persons with physically impairments, the Norwegian Association of Deaf people, and the Norwegian Association of the Blind.

We have placed the NGOs under the heading *Innovation* even though they do not directly participate in innovation. Their influence is more indirect. Their main mission is advocacy work towards the Government. Thru this work they influence the framework for innovation and the rules and regulations of the assistive technology system. They are important advocates for Universal design, and they are working on accessibility and equal rights. Presently, they are occupied with promoting the inclusion of ICT in the coming anti-discrimination act, and with universal design of ICT in all areas of society, including working life. But, the organisations are represented in the User-forum of IT-funk presented under. As part of this forum they are able to exert influence on research that could promote more inclusive ICT. From the interviews with producers we learned that they

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[39] Employers' organisations and unions.

have tight contact with user-representatives in the innovation phase, but these users are not always recruited thru the organisations, but through other rehabilitation institutions etc.

Delta Centre

The Delta Centre was established by the Government in 2001 as a national information and counselling office on accessibility under the Directorate for Health and Social Affairs. The Centre has a strategic role as it engages in work to promote universal design, takes part in working out guidelines, for example, for accessible web pages and they may contribute to funding of relevant projects and research. The activities of the Delta Centre are not specifically related to employment, but they have been engaged in employment as one of several other areas. They have also funded research projects related to universal design, ICT and workplaces.

The Research Council of Norway (RCN)

The Research Council of Norway (RCN) (http://www.rcn.no/) is a strategic body that identifies areas of special effort, allocates research funds and evaluates research. The Council is the principal research policy adviser to the government, and it acts as a meeting-place and network-builder for Norwegian research.

RCN has an annual budget of more than NOK 5 billion and plays a central role in Norwegian research. The mandate of the Council is to promote and support basic and applied research in all areas of science, technology, medicine and the humanities. Important goals include supporting innovation in all sectors and branches of industry.

RCN funds many projects within the ICT and related areas. Among these are the 14 Centres for Research-based Innovation (CRIs). The main objective for the CRIs is to enhance the capability of the business sector to innovate by focusing on long-term research based on forging close alliances between research-intensive enterprises and prominent research groups. The CRI scheme seeks to:

- Encourage enterprises to innovate by placing stronger emphasis on long-term research and by making it attractive for enterprises that work in the international arena to establish R&D activities in Norway.
- Facilitate active alliances between innovative enterprises and prominent research groups.
- Promote the development of industrially oriented research groups that are on the cutting edge of international research and are part of strong international networks.
- Stimulate researcher training in fields of importance to the business community, and encourage the transfer of research-based knowledge and technology.

The host institution for a CRI can be a university, a university college or a research institute, or an enterprise with a strong research activity. The host institution should have a strong reputation within the disciplines or industrial areas the centre addresses. The partners (enterprises, public organisations and other research institutions) must contribute to the centre in the form of funding, facilities, competence and their own efforts throughout

the life cycle of the centre. Partners must point out the commercial potential that they envisage will result from the centre's activities.

At the moment, 4 out of the 14 CRIs are engaged with ICT related issues; two with Medicine and ICT, and two with more general ICT issues. None of the CRIs addresses ICT and disabilities specifically.

Among the social scientific RCN funds, some also address the issue of ICT and people with disabilities, universal design, etc. The indisputably most important in this context is IT-funk. RCN's total contribution to R&D on ICT-based AT is 5,3 mill NOK for 2007.

IT-funk

In 1998, the Research Council of Norway was commissioned by the Norwegian government to set up a R&D program on information technology for the disabled (acronym IT Funk) (http://www.itfunk.org/docs/engpres.html). IT Funk receives it's funding from two Ministries: Ministry of Industry and Trade and Ministry of Labour and Social Inclusion. In 2006, the Government decided to carry on the project until 2012 and granted 38 mill NOK for the six-year period. For this period employment is one of the prioritised areas. The main part of the budget comes from the Ministry of Labour and Social Inclusion (32 mill NOK), while the second Ministry has granted less and less money over the years. In addition to the funding from the Government, a 50 % contribution is expected from the participating companies and parties in the projects.

The purpose of IT Funk is to:

Contribute to accessibility for all, including the disabled, to information and communication technology (ICT) and to society through the use of ICT.

The strategy of IT Funk is to:

- promote the use of universal design principles in research and development of ICT and ICT-based products and services, for both the public and private sector,
- support development of assistive technology that complements and interacts smoothly with standard technology,
- promote Norwegian participation in relevant international R&D and standardisation programmes and projects,
- require the use of standards and guidelines for accessibility to ICT-based products and services in all projects funded by the Norwegian Research Council and other public bodies,
- promote broad-based user participation in research, development and implementation of ICT-based solutions everywhere in society,
- pay special attention to areas where accessibility issues impact on a person's life chances, in particular education and training, the workplace and basic services to citizens.

IT Funk targets businesses and institutions that research, develop, produce and distribute ICT-based products and services of importance for accessibility in society. In collaboration with other R&D-programs, IT Funk provides financial support to projects based on universal design-principles and to projects on assistive technologies. Enterprises in the ICT sector are in charge of most of the projects, so that the products and services devel-

oped will be updated and available in the market in the future. An important precondition for funding of projects is user involvement. The users have a kind of veto in the process both through the mandate of user involvement in all projects, but most of all as represented in the User-forum. If they turn their thumbs down for further support, the money dries out immediately. In this way IT Funk intends to promote the development of products that are useful for the intended user groups.

IT-funk expects that knowledge acquired in the projects will be diffused thus increasing the use of universal design-principles in the company as a whole. A major viewpoint is that inclusive and user-friendly products are an advantage for all, not just for the disabled.

A number of the projects supported by IT Funk have in a later phase also received support from EU's 6th Framework programme and many have led to development of products that are available in the market.

In the period between it's formation in 1998 and 2004, It Funk supported more than 50 R&D projects. Examples of companies that has received project funding from IT Funk are: Opera Software ASA, SINTEF IKT, Norsk Regnesentral (NR), University College of Østfold, Department of Information Technology, Human Factors Solutions ANS, MediaLT, Telenor R&D, Falck Igel AS og NorMedia AS. Many others could be mentioned, but these examples will suffice to illustrate the point that several actors are involved in R&D on ICT for people with disabilities funded by IT Funk.

IT Funk has been evaluated twice. A comprehensive evaluation was conducted in 2002 (Pharos & Moereforskning 2002) and a second one in 2005 (Ekeland et. al.2005). The last one had a focus on the future destiny of 48 selected projects that had received support from IT Funk. The evaluation concluded that, given a limited market and limited resources, many of the projects obtained good results and successful products. The evaluators also mentioned that IT Funk's "User forum", which consists of all the major stakeholder groups in the field, is an important forum for exchange of information and influence from user groups. Furthermore, the evaluators concluded that IT Funk uses its limited resources in a clever and cost-efficient way and with good timing in the right phases of the innovation and development processes. One of the main functions of IT Funk is the networking function it undertakes. IT Funk uses "resource coupling" as a method to stimulate and initiate R&D processes in the early phases. They put researchers, companies, users and other important stakeholders in contact with each other.

For the small and often idealistic companies involved in the projects, the money and recognition they receive from IT Funk is considered important for their motivation to go on with the process. The limited means they receive from IT Funk triggers a lot of their own efforts.

IT Funk also works via and uses other existing funding organisations like "Skattefunn" and Innovation Norway.

According to the Director of IT Funk, it is possible to identify four research milieus that could be described as main drivers in the field of R&D of ICT-based assistive technology and general technology for people with disabilities in Norway. This is Norsk Regnesentral (Norwegian Computing Centre), Institutt for informatikk, Universitetet i Oslo (Institute for informatics at the University of Oslo), NTNU (The Norwegian Polytechnical University in Trondheim), and Sintef

Innovation Norway (Innovasjon Norge)

Innovation Norway (IN) (http://www.innovasjonnorge.no/system/Global-toppmeny/English/) promotes nationwide industrial development profitable to both the business economy and Norway's national economy, and seeks to "release the potential of different districts and regions by contributing towards innovation, internationalisation and promotion". IN is a state owned company and employs more than 700 people. It has offices in all the Norwegian counties and in more than 30 countries worldwide. The head office is located in Oslo. The major clients are Norwegian companies, predominantly SMEs.

IN also contributes with funding for SMEs trying to develop new assistive technology or ICT for people with disabilities. The funding is often seen in a context of "regional development".

IN collaborate with IT Funk and has a representative in IT Funk's User Forum. IN is also represented in the "Skattefunn" scheme, which is a tax reducing scheme for SMEs that engage in R&D processes. IN and IT Funk collaborate especially through two types of R&D contracts used by IN called OFU and IFU (respectively Public and industrial R&D contracts).

Universities and university colleges

Several of the Norwegian universities, and organisations and institutes emerging from universities, are involved in research and development of general as well as specialized ICT for people with disabilities. Some of the projects are funded by the Research Council while others are funded from other sources.

The Norwegian University of Science and Technology (NTNU) is involved in R&D in synthetic speech, voice recognition as well as other ICT-based assistive technologies. The Department of informatics at the University of Oslo (UiO) has research groups such as "Design of Information Systems", "Robotics and Intelligent systems" and others that are working in relevant fields. The Simula Research Laboratory under UiO conducts basic research in the fields of communication technology, scientific computing and software engineering. Their research "focuses on fundamental scientific problems with a large potential for important applications in society" (http://www.simula.no/), which means that they are not explicitly engaged in ICT-based technology for people with disabilities. The Institute of Special Pedagogy at UiO is another actor involved in development of ICT for people with disabilities.

Gjøvik University College (www.hig.no/) has established a study for engineers in Technology Design, which focuses specifically on universal design. Also other university colleges are players in the arena concerned with R&D with relevance for people with disabilities. Examples here are the University Colleges in Oslo (www.hio.no), Bodø (www.hibo.no) and Lillehammer (www.hil.no).

Production and supply

General ICT producers:
Accessibility to general ICT is an important element to enable participation in today's working life. Microsoft and IBM are the largest companies delivering ICT tools to workplaces in Norway. Microsoft has definitively the strongest position.

Microsoft
Microsoft dominates the software market and their programs and solutions constitute an important framework, both for disabled people using their programs and operating systems at workplaces and for producers of assistive technology that shall be compatible with operating systems and programs.

Accessibility and usability has been more emphasized in recent programs and solutions from Microsoft. In their latest operating system, Vista, accessibility features designed to assist persons with physical challenges, with their use of the computer, have been built in. It is possible to adjust settings so as to improve abilities concerning hearing, vision and use of arms. (For example high contrasts, synthetic speech and on-screen keyboards). Next year Microsoft has promised to introduce a free downloadable tool for Microsoft Office that will make it possible to save Word documents in the digital audio book version DAISY. "Save as Daisy" will make it possible to translate text to speech. If this promise is realised, it could open new possibilities also at work places for employees with vision impairments. Microsoft cooperates with selected producers of assistive technology, to assure that their products are ready when Microsoft delivers new programs and operating systems. This is not the case for most of the producers of assistive technology, especially not in Norway. Microsoft builds on proprietary solutions and as such does not use open standards and open source This means that there constantly will be a lag between available new programs and solutions from Microsoft, and available assistive technology that is compatible with these new products.

Producers and suppliers of assistive technology
The majority of the Norwegian actors supplying buyers and users with ICT-based assistive technology are *suppliers and adaptors* rather than innovators and producers. They distribute technological solutions developed elsewhere (USA, Japan, Germany, etc) and adapt them to fit in with local Norwegian demands, user needs and quality and characteristics required by the public procurers. The majority of the suppliers, however, are actors in the *Nordic* market rather than in an international market. A typical competitor for a supplier is another Nordic company.

The suppliers are organised in the Association of Suppliers of AT for the Health sector. The association has 140 member companies, but only a minority of these companies are dealing mainly with AT for people with disabilities. The single market and monopoly customer for most of the companies is the Norwegian Labour and Welfare Organisation (NAV). In one way this leaves the companies in a vulnerable and dependent position vis a

vis the mighty public procurer, but in another way - according to informants in the supplier sector - this mighty procurer in a so far generous welfare system has made the Norwegian market interesting for the assistive technology industry.

In the following we describe the main suppliers of ICT-based assistive technology in Norway. Most of them are mainly operating in the Norwegian or Nordic market. Some of them are wholly owned subsidiaries of Nordic or European companies. Many of the suppliers and companies are not only engaged in providing products, but also different kinds of courses and of course implementation etc.

Within sight, dyslexia and reading disorders there are five main suppliers. Bojo AS is one of the largest, started in 1982 and with eight employees. Bojo was originally Norwegian owned, but is today a wholly owned subsidiary of Polar Print Holding AB which is North-Europe's largest supplier of assistive technology for the visually impaired. Polar Print Holding also owns Bojo's two sister companies in Sweden and Finland. Another large actor is Tagarno Norge (Tagarno Norway Ltd) that has seven employees and was established as a Norwegian Ltd company in 1990. It is a wholly owned subsidiary of Tagarno Denmark. It has sister companies in Sweden and Finland. ProVista is Norwegian and is another provider in this area, was established in 1999, and has 10 employees. They describe their activity as "deliver competence and products within the field of rehabilitation of persons with visual impairments". The fifth we will mention is Syn-Support. The company has five employees in Norway and the same in Sweden. They develop, produce and market individually adapted enlargement video systems for the visually impaired.

Within ICT relevant for movement, we find the same characteristics as within ICT relevant for sight. The main company is Nordic based. There are not many companies specializing in ICT relevant for movement. The largest, Permobil, was established in 1963 in Sweden, while the Norwegian company was established in 1981. The company is owned by Nordic Capital Fond V. It is a leading global company within production of electric wheel chairs. Today the company has subsidiaries in most of Europe and in the USA. Viking Software AS is a Norwegian software company established in 1999. The company's mission is to develop software for people with different moving impairments and learning problems.

The third area we will mention is ICT relevant for communication with several major companies. In this group we find a large Norwegian based company. Falck Vital AS and IGEL Kompaniet AS merged into Falck Igel AS as of the first of September 2007. It then became the biggest Nordic company within communication, cognition and alarms for persons with disabilities. The two former companies have collaborated for several years in the Norwegian market. The company has approximately 50 people in Norway and Sweden and are currently hiring in Denmark. Another company is GEWA, started in 1970 in Sweden by the son of a man with Multiple Sclerosis. The first product was a page-turner. In Norway, Gewa AS was established in 1986 and is a wholly owned Norwegian limited company. The company has 17 employees working in the following five fields: hearing, speech (ICT, sight, environment control and alarms. Tobii Technology, founded in 2001, is developing and producing hardware and software solutions for eye tracking. Eye tracking enables a computer to tell exactly where a person is looking. Their head office is in Stockholm, Sweden, with offices also in the US. Their products are sold through resellers and partners worldwide. Mikrodaisy AS was established in 1984. They are one of the main suppliers of pedagogical software for people with reading disorders and dyslexia to the

educational system. They also develop software as well as hardware and network solutions. Mikrodaisy also delivers Microsoft licences and other products to the educational system. It is an important supplier of special assistive technology to the Assistive Technology Centres. They also export their products to the other Nordic countries and UK. In 2002 Mikrodaisy COMPANY (Mikrodaisy BEDRIFT) was established to cover the workplace market. They offer technical support and services.. This is the only company we have found that specialises in the workplace market. Cognita as is a supplier of ICT-based assistive technology – software as well as hardware - for people with cognitive and physical impairments. They also offer training in use of the equipment they deliver.

Some of the mentioned companies offer comprehensive solutions where technological aids are combined with training and adjustments. Such package deal enables the Assistive Technology Centres to record expenses in the budgets for support, which in principle are limitless. The alternative is to record expenses under the operating budget, which is restricted.

The Norwegian market for assistive technology (AT) is small. Most of the Norwegian producers are small companies with limited financial resources. They have a limited ability to carry the financial burdens of R&D and they therefore from time to time market *prototypes* as final products towards the public procurers in NAV.

Consultants:

The private consultants and providers of services must also be mentioned. There are not many of them in the Norwegian market, but there are a few. We will mention three: Include, Volar and Ablecon. The first one has a widely recognized expertise in universal design and is frequently consulted by for example SIKTE and NONITE, which are the experts on ICT and disabilities in NAV (the Norwegian Labour and Welfare Organisation). Ablecon is also consulted by NAV to assist in accommodation of workplaces for people with disabilities. Volar's main activities are connected to supporting people with disabilities (especially the sight-and hearing impaired) in finding and adjusting jobs. They are contracted by NAV and often collaborate with participants on the labour market scheme Supported Employment.

Diffusion

NGO

We have introduced the NGOs under the heading "innovation", but they are just as relevant in the diffusion phase. The NGOs could be called an indirect actor as they play an important role in the communication of the users experiences with the diffusion system, also related to employment. Many of the organizations are occupied with the diffusion system and advocacy towards the Government in this area.

Norwegian Labour and Welfare Organisation (NAV)

At the national level, assistive technology for disabled people is the responsibility of the National Labour and Welfare Organisation (NAV). They have the overall professional, financial and administrative responsibility for assistive technology in Norway. This is a public, tax-financed responsibility. The right to assistive aid is covered in the National Insurance Act (NIA) and the National Insurance covers the costs of assistive aid for people with disabilities. In relation to working life § 10-5 in the NIA defines the right to *"Support to increase functional ability in working life"*. The term means that the person has had their *"capabilities to carry out income aggregating work long lasting reduced or have had their possibilities to choose occupation or workplace considerably reduced"*. There are similar rights to assistive aid to increase capabilities / degree of functioning in daily life.

Within NAV at national level there are five different departments for areas sorting under NAV. Relevant for this study is: NAV Work and Activity NAV Special Units, and NAV Operation and Development. One of the areas within NAV Work and Activity is labour market measures and assistive aid. This activity is locally administrated by the local NAV offices in every municipality. NAV Special Units have the policy responsibility within the field of assistive aid. They have a separate department for all the Assistive technology centres at the county level as well as other special units in this area. These are two national competence centres for ICT and disability; SIKTE, NONITE, and also relevant in this area a Centre for Occupational Rehabilitation (SYA). NAV Operation and Development has a large responsibility for administration, operation and economy. ICT operation and public procurements sorts under this area. Interesting for this is the Reference Group for Price Negotiations (RGPN).

Reference Group for Price Negotiations (RGPN)

Reference Group for Price Negotiations is the crucial mechanism in the public procurement process. The main tasks for this body is to publish calls for tenders for various products of assistive technology, assess the products that are offered from the suppliers according to certain criteria, negotiate prices and recommend products to be listed in the official purchase manual (the "pink catalogue") of recommended and certified AT products. There is not a separate catalogue for employment, but one general catalogue. The products listed in this manual are the main assortment of assistive technologies from which the Assistive Technology Centres have to select and recommend aids for the individual users. However, if there are no available products that can cover the needs of specific users in an adequate way, the Assistive Technology Centres are allowed to purchase products outside of the catalogue. In this case, suppliers with approved products in the "pink catalogue" can file a suit if they think their products can cover the same needs in an equally adequate way.

The "Pink catalogue" undergoes a revision every second year. It happens from time to time, that products/producers are taken out of the catalogue. Companies with new products that they want to have assessed for the catalogue, have to adapt to the two-year cycle of revision. In some cases the timing of marketing a new product can be critical and a question of life or death for firms with a weak equity.

There is one RGPN for each area of disability (sight impairment, hearing impairment, etc). Each group is staffed with representatives from the NAV Operation and Develop-

ment department, SIKTE (Centre for ICT-based assistive technology), County Assistive Technology Centres (ACT) and NGOs.

This is mostly a national market scene. The producers and suppliers are on the whole dependent on the national market represented by public procurement. In NAV's calls for tenders, there are normally no foreign competitors participating. In addition, the products are frequently so specialized that they have no natural competitors. In these cases the situation approaches local monopolies.

SIKTE

NAV Centre for ICT aids (SIKTE) is a national competence centre for assistive technology concerning ICT. In general SIKTE is concerned with all areas of life, also employment. They develop assistive technology and new methods for testing, implementation and use of ICT-based AT. SIKTE's target groups are people with complex challenges in movement and mobility caused by congenital and acquired physical impairment as well as acquired brain damage. Another group is made up of individuals with congenital or acquired combined loss of vision and hearing. All target groups experience severe challenges in communication to different degrees. The centre gives advice on choice of ICT equipment and individual adjustments as a supplement to the ordinary assistive technology system. They also work with developing and testing of new ICT in cooperation with users and producers.

NONITE

The North Norwegian ICT Centre (NONITE) is a competence centre at the national level, but with a special responsibility for the four northern counties. The centre is related to SIKTE, but is situated in the city of Bodø in the north of Norway. They develop and distribute knowledge on ICT aid with the purpose that disabled people can make use of technology to achieve equal participation in society. Their main issues are to develop knowledge thru project work, systemize and spread knowledge from the project work, develop and produce training materials. Some of their projects are on employment and work issues.

Centre for vocational rehabilitation (SYA)

NAV SYA offers various services for vocationally handicapped jobseekers. An important task is also to develop new and improve existing methods for vocational rehabilitation for their target groups. The main target groups are job seekers with disabilities who are insecure of their working ability, interest and career wishes. SYA has specialized teams within hearing impairments, visual impairments and neurological injuries and disorders. They are conducting tests and assessments of the jobseekers' reading disorders, hearing and visual functioning, interpersonal skills, pace of work, concentration, attention span, memory, etc. They are also advising on use and adaptation of assistive technology.

SYA's most important collaborating partners are the local employment offices (NAV Lokal Arbeid). They refer the jobseekers to SYA. Other important collaborators are the Assistive Technology Centres, pedagogical competence centres and employers.

Assistive technology centres

The Assistive technology centre (ATC) is part of NAV, at the county level. There is one Assistive technology centre in every county (19 in total) with the overall and coordinating responsibility for assistive technology in their county. These centres are competence centres for assistive technology and the main institution for the diffusion of assistive technology to disabled people both for daily life, education and working life.

The Assistive technology centres are assigned functions for working with the users; assessing the needs for assistive technology, giving advice and guidance on available ICT tools and solutions, treat the applications of aids and make decisions, and in the end deliver the products. They provide financial support or lend out assistive technology to persons. In many cases advisors from the ATC make installations and adjustments at workplaces.

The ATC also work with different actors involved in disabled people and working life. They are involved in meetings with Work life centres, with the local Work and Welfare offices, with occupational health services, and the municipal health services. One of their assignments is to spread knowledge about assistive technology.

There is different legislation concerning the right to assistive technology for daily life and working life. The fundament for both is based on the person having a lasting (2 year) impairment causing a handicap. For ICT in working life the National Insurance will cover ICT tools if they can be defined as assistive technology or ICT tools that cannot be defined as ordinary ICT tools at the work place. The employer should finance ordinary ICT tools and adjustments of the workplace. There has been a circular from the central government emphasizing that the assistive technology centres and Work and Welfare organizations are important actors in the efforts for a more inclusive working life. The advisors at the Assistive technology centres should think goal oriented when they assess each work related case concerning assistive technology, and keep in mind that it is important to help people stay in work or get into working life (Circular from NAV 21.06.2006).

From 2006 the Assistive Technology Centres have introduced a Guarantee Certificate, a guarantee for quick help and assistance for adjustment of workplaces. This arrangement came as a consequence of users experiencing that it could take very long time before they received the support, equipment and guidance they needed. The aim of this arrangement is to make it easier for disabled job seekers to be considered in an employment process.

Work life Centres

The Work life centre is a competence and advice centre within NAV at the county level for inclusive working life and workplace accommodations. Their main task is to follow up companies that have signed an Inclusive work life agreement (IA), and help them work on the targets for reducing sick leave, preventing early retirement and preventing persons with reduced working capacity to fall out of working life and to also recruit more disabled people. If a company has signed an IA-agreement they are given a personal adviser at the work life centre to assist them. As of the 2nd quarter 2007, 21% of all Norwegian companies were registered as Inclusive Worklife Companies, while 54% of all employees were covered by the IA agreement (http://nav.no/805358745.cms).

The Work life centre administers an adjustment subsidy available for IA-companies. Companies can apply for this subsidy when workplace adjustments necessary for one em-

ployee lead to additional expenditures for the company. The aim is to stimulate employers to make adjustments so that employees can stay in work despite heath problems. The subsidy could be granted for groups of employees as well. The amount is limited. This subsidy could cover a large range of activities, but also assistive aid / working aids not covered by the National Insurance[40].

Local Labour and Welfare offices
In every municipality there is a local office of NAV. This office has one unit that is specially occupied with work. Disabled people looking for a job must make contact with the local NAV office. They are also responsible for unemployment benefits and different programmes for getting people in to a work situation, as well as occupational rehabilitation. They give advice on how to apply for AT.

Municipal community health services
Doctors, ergonomists, physiotherapists and others within the community health service could be an actor concerning some users trying to get in to work, thru occupational rehabilitation. The municipal community health service is also in many cases an important partner in applying for AT as the application should be based on documentation of the impairments and assessments of needs.

Occupational health service
The occupational health service can be an actor conserving employees with impairments and in need of assistive technology. They will often be involved when employees have long time sick leave or cases with adjusting the workplace so that employees can stay in work.

Implementation at the work place

There could be many actors involved in implementation of ICT at the work places. In some cases also producers and deliverers of assistive technology are involved in implementation at work places. The list of actors below is the actors that based on our interviews appear as the most important in the implementation phase.

The employee / job-seeker in need of assistive technology
The most important actor in implementation / use of ICT is the employee at the work place. There will be different groups of employees in need of assistive technology. There are employees with a well-known need for assistive technology, but there will also be em-

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[40] Users not entitled to assistive technology due to lasting (cronically) illness, impairment or injuries covered by NI § 10-5.

ployees where the needs are not defined, or the user does not know that there is technology available to increase their abilities at the workplace.

Company – Employer

The employer is an important actor in the implementation process. The employer hires employees, and must be involved in getting available ICT implemented.

The Working Environmental Act provides a legal protection against discrimination in working life. This act also places a responsibility on the employer for adjustments of the workplace.

The employer has a role both as a potential identifier of needs, establishing contact with relevant milieus for assistance, but also as a gatekeeper for implementation of ICT tools. If the employee does not have a documented lasting impairment, the employer will be financially responsible for any adjustments and tools at the work place. For equipment that could be defined as ordinary ICT tools, the employer would be financial responsible.

Company – ICT support

The department of ICT support at the workplace is an important actor. Most often the person from the Assistive technology center or other actors responsible for installing the equipment at the work place are dependent on establishing a good relation to the local ICT person to find good solutions for the employee.

Assitivte technology centres

Assistive technology centres will very often be involved in implementing technology at workplaces. In many cases they work with assessment of workplaces, installations and finding solutions that works for the employee.

Suppliers

In some cases the suppliers will install the equipment at the workplaces.

Consultancy

Ablecon and other firms are consulted by NAV to assist in accommodation of workplaces for disabled people.

Relations between the actors in the system

In this chapter we analyse the roles and relations between the actors in the system. We have structured this according to the different phases introduced earlier ; innovation, production, diffusion and implementation.

The first part is concentrated on the innovation – development – production phase. The second part is about the diffusion – implementation phase at the workplace. This part is about the role and relations between actors within diffusion and actors involved in implementation and use at the work place. This part is in many ways the most extensive part, and also an important part to illustrate the eventual barriers for utilizing ICT at workplaces as a measure for a more inclusive working life. In addition, by analysing the data, we realised that we needed a new phase or heading – called Need and Problem Recognition. The third part is explicit about need and problem recognition with a focus on whether uncovered needs and problems are communicated to innovation milieus.

The innovation and development phase

The Government

As described earlier the Government plays a regulative role within innovation and development, even though this could be described as an indirect role. The latest years there has been an increasing focus on digital inclusion, emphasising universal design and accessibility. We do not have much data on how this influences producers and developers. We have to investigate further how the new proposal, from the government, that all new ICT directed towards the public should be of universal design by 2011, affects the market. Several of our informants, users and employees at the assistive technology centres says that they think that several general ICT products have become more user-friendly these last years, and that many producers have understood that more user-friendly products open a larger market. One of the informants at an assistive technology centre points out several new accessibility settings in one of Microsoft's new products. One of the reasons for this could be the Anti-discrimination legislation in USA influencing the global market. It remains to be seen if initiatives in Norway to promote universal design will have the any affect.

From one of the interviews with a governmental competence centre we discovered that universal design is still not understood within the field of ICT are and that is not well known within the development milieus. This informant tells about a young man he knows who studies software engineering and who had raised the question about universal design at a lecture. The issue was not familiar to the teacher and most certainly not among the other students. This illustrates that there is a way to go before universal design is well known in the field of ICT. IT-Funk plays a role here by making universal design a criteria

for the projects they support, although it seems that stronger regulation or awareness is necessary to make universal design better known in the general ICT milieus. A better understanding about the importance of accessibility and universal design is necessary in the training of ICT supporters and software engineers.

The Government often uses the Delta Centre as an expert body entitled to comment in consultative rounds in policy fields related to disabilities, accessibility and universal design. They have been active on working out guidelines on universal design and also initiated research and projects that will provide more knowledge about universal design. Main activities include gathering and disseminating knowledge on what leads to or prevents accessibility for persons with disabilities. They co-operate with professional bodies, user organisations, research institutes and private enterprises.

The Government also plays an important role by financing assistive aid, and regulating the market for assistive technology by public procurements rules.

Finally, the Government plays a direct role in innovation and production by using different grants and funding.

Research funding

The Research Council of Norway (RCN) plays an important role in the research and development phase of new ICT solutions and products by identifying areas of special effort and allocating research funds to prioritised projects. RCN is funds a broad range of R&D projects with relevance for ICT, disabilities and work.

IT-Funk is mentioned by one of our informants as important in the starting phase of developing what today is one of the main products in the company he works for. This informants stress that the most important support they got from IT-Funk was the access to relevant research networks and other persons important to the further development of their project. The actual funding from IT-Funk was not very high.

For this period IT-Funk has work / labour market as one of their prioritised areas. IT Funk works through expert networks on ICT, dialogue with user organisations and by supporting international cooperation in R&D and efforts to increase awareness and knowledge in the ICT-community of user needs and accessibility challenges.

A number of the projects supported by IT Funk have, in a later development phase, received support for example from EU's 6th Framework programme (in 2006, four projects received funding). A number of projects are at the moment applying for funding under the 7th FP. Many projects supported by IT Funk have led to the development of products that later became available in the market.

Significant barriers impeding more available and potentially useful ICT for people with disabilities in this phase of innovation are:

- limited financial resources. Projects are funded on a 50/50 basis between IT Funk and participating companies. IT Funk's budget is restricted (1 mill Euro pr year);
- most participating companies are small. It is often a problem for them to fund development projects through the necessary phases until they are commercialised and launched on the market;
- launching and commercialisation of products with international potential, requires larger resources and more collaborating partners than what is the case in most IT Funk projects.

Innovation Norway (IN)

Another source of public funding is Innovation Norway. Of special importance for the field of assistive technology are the "Research and development contracts". One of our informants tells that his company has received funding from IN, based on a R&D contract. This funding is based on binding contracts between a product developer and a public service department (OFU) or a private enterprise (IFU). Presently, NAV encourages their Assistive technology centres to involve themselves in such contracts as a means to more innovation. A potential barrier for this funding is that it is limited to the development phase.

The Norwegian NGOs

The Norwegian NGOs in the disability field are not considered as direct drivers or forces for innovation and development by themselves or by the other actors involved in the system. Their role is more indirect. They work actively on policy level. They use official and public channels for passing on their views. Several NGOs are for example represented in a user forum established by IT-Funk, where they influence what kind of projects IT-Funk supports. Our informants in the user-organisations also stress that they provide feedback on the policy level concerning the practises of the assistive technology centres. They are also actively involved as advocates for universal design in the field of ICT.

We find that the NGOs rarely have direct contact with the producers in this field. There are no arranged meeting places or fairs of ICT based assistive technology. Rather, we find that the NGO's feedback on solutions, products and assortment to a large degree is reserved for NAV, who they consider as the legitimate and appropriate dialogue partner for the producers and suppliers. NAV therefore negotiates on behalf of the needs articulated by the NGOs. We can conclude from the interviews with different actors that the NGOs normally prefer to make their voices heard in consultative rounds and by their presence in various committees and Government bodies. They are not very active in direct dialogue with innovators, developers or producers. Certain persons, who are not necessarily recruited thru the NGOs, are involved in testing of products and working with producers during their development of new products.

We find that a potential barrier in the Norwegian system is too few meeting places gathering NGOs of disabled people, disabled people using ICT and ICT based assistive technology, producers and deliverers of ICT solutions. Today's practice is based on the Government and the NAV system being able to communicate the views, opinions, experiences and needs of disabled people.

NAV – the main public procurer

As the main public procurer, NAV emphasizes a non- favouring policy towards the producers and suppliers of assistive technology that participate in the bi-annual call for tenders. In a small country such as Norway, with clearly defined social networks and often personal social bonds between producers and public procurers developed over many years of collaboration, a "neutral" attitude is not always easy to maintain in practice.

Some producers and suppliers are active in offering seminars, trainings courses etc where professional lectures are combined with promotion of services and products. Pro-

fessionals from NAV are frequently invited to these seminars or workshops. Many consider them as important channels for professional information and for being updated on what is going on in the field and for networking. The limited budgets for the professionals to participate in various seminars and conferences– national as well as international - are frequently the object of the professionals' complaints and it is argued that they cannot keep sufficiently updated with such limited budgets. To a certain degree, also the suppliers and producers are looking for more places where they can meet the public procurers and present innovations.

As the main Norwegian public procurer, NAV is *the* market for the producers and suppliers of ICT based assistive technology. Every second year, a call for tenders for various assistive technology is published. The Reference Group for Price Negotiations (RGPN) administers the tender process. For each disability area (vision, hearing, movement, etc) a subgroup of RGPN is established. As mentioned above, the recommended products are listed in the "Pink catalogue" which is the range of assistive technology products the county Assistive technology centres have to select from. For many years the availability of a broad range of assistive technology products has been considered as the norm.

As of November 2006, the system for public procurement and call for tenders was changed. From this date, NAV has decided to select only one supplier per product, compared to the previous system where it was allowed to list several suppliers of each product in the "Pink Catalogue" – which is the official purchase manual listing all the allowed products. The merging of the previous Norwegian Labour and Welfare administrations into one – NAV – has changed the relations between the public procurer and the suppliers as well as the system and rules for purchase and supply. One consequence is NAV's call for tenders for *parts of products* rather than complete products. Economists and rehabilitation professionals in NAV are organised into separate departments. According to the suppliers, the new organisational structure together with an "too strict and misunderstood" adaptation to EU regulations for public procurement, has led to several negative and dysfunctional consequences for the supply and adaptation of AT for people with disabilities. Amongst others, it is argued that the new incentive structure weakens the suppliers' economic opportunities, interests and motivation for further innovation, development and adjustment of the products they deliver. The consequences for the end users will be negative, they argue. The reform has only been effective for a year, and we do not have any data which can support or weaken these arguments so far.

NAV is arguing that they intend to avoid "parallel agreements", i.e. agreements with several suppliers offering the same products or services. The suppliers' organisations are criticizing this policy, arguing that many small producers will close down, leaving the market to the big companies alone and thus stimulate the development of monopolies. However, this process is still in an early phase, which makes it difficult to assess the results of the reform yet. Even though this concern is also shared by two of the NGOs we have interviewed, they stress that a certain assortment is necessary. For example, deciding on one reading list cannot be the answer to the needs of all blind people. Different persons have different needs, and the different products have different qualities that suit different users. One of the informants stresses that the system relies on the people in the reference group having good competence and knowledge about the needs of the users. This person thinks that the group, so far, has secured a good assortment of varied products. He thinks the main reason for this is that people with wide competence about the user-needs have

been represented in the committee. This informant also states that he knows that for other groups of impairment this has not been the case.

When analysing NAV as the main public procurer we can identify several potential barriers for securing an assortment of ICT products that cover the needs of disabled people. One is that there are no arranged meeting places for the innovators and producers to present their product between the arranged tenders. Another potential barrier for a good assortment is a changing policy not allowing "parallel agreements". A third potential barrier is that the subgroups assessing new products for recommendation may not have adequate competence about the needs of the users.

Producers and suppliers - diffusion

As has become evident from the presentation above, most of the producers and suppliers of ICT-based assistive technology in Norway are small companies. Some of them are however wholly owned subsidiaries of foreign companies, like for example Bojo as Tagarno Norway and Handy Tech. Furthermore, most of them are suppliers rather than innovators and producers, but some of them are involved in all of the three areas. They operate mainly in the Nordic market.

The companies point to several barriers against a better diffusion and adaptation rate of ICT-based assistive technology. One is the long time it takes for a new product to be approved and listed in the "Pink catalogue". In cases where small companies have made investments in innovation and development of new products, the time it takes for the product get to the market and be commercialised, is sometimes critical. Small companies do not always have the financial resources to tolerate long lag times. However, IT Funk sometimes plays an important role in this context. A known strategy, which some companies use, from time to time, in order to minimize financial risk, is to market prototypes under the cover of being final products. If they are successful and the product is listed in the Pink catalogue, they become able to finance further development of the product. More and more the producers and suppliers demand a certain volume in NAV's purchase of their products to be willing to establish local distributors in Norway. Otherwise, the market becomes too small and commercially uninteresting for them. In this context, it should be mentioned that the suppliers are worried about the consequences of the new rules, regarding call for tenders for public procurement of their products. They argue that the new system, for economic reasons, will lead to more standardisation and less individual adjustments of the products. The new call for tenders system, asking for tenders for *parts* rather than complete *products*, and priority of *price*, will weaken their economic possibilities to employ and preserve a sufficient environment of professionals that can advise and assist the users of their products. Since they more and more expect to become suppliers of *parts,* they cannot be held responsible for the functioning of the complete products and the buyers cannot expect them to maintain a service and support system for the products, they argue.

Even if a new product has been approved and listed in the "Pink catalogue", the county Assistive technology centres follow different practices regarding which products they purchase, thus making the market smaller and more insecure for the suppliers. Since the Assistive technology centres act as negotiators between the end users and the suppliers, they decide to a large degree which types of assistive technology are available for the end users.

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The existence of different opinions between the Assistive technology centres regarding the quality, suitability and cost-benefit balance of certain assistive technology products can thus sometimes represent a barrier against diffusion and availability.

There is a lack of information and knowledge about innovations and available products among the Assistive technology centres and to a even larger degree among employers. There are indications that the lack of a sufficient number and types of common meeting places between suppliers and purchasers and between Assistive technology centres and employers, is an obstacle against a fuller exploitation of the potentials in ICT as an assistive technology.

By analysing the relation between the producers / suppliers and diffusion we can identify several potential barriers to a better diffusion of ICT based assistive technology. One is the time between each arranged tender by NAV which constitutes a risk that small enterprises will not survive long enough to get their products on the market. Another potential barrier is that some international producers / suppliers demand a certain volume of products to be purchased by NAV in order to find the market commercially interesting enough to establish local distributors in Norway. A third potential barrier is that even though the product is approved in the "pink catalogue" a lack of knowledge among users and professionals at the Assistive technology centre can be a barrier for adoption of the product.

Relations between producers/suppliers and the Assistive technology centres

As mentioned above, the Assistive technology centres are instructed from NAV's central administration to handle their interaction with producers and suppliers in a careful and non-favouring way. NAV company policies and body of rules regulate the transactions. The Assistive technology centres have a certain autonomy regarding which assistive technology products they purchase, as long as the product is in the "Pink catalogue". But they can also purchase assistive technology products that are not listed, given that they have good arguments for it.

Many Assistive technology centres have frequent contact with the suppliers. They act as negotiators between the end users and suppliers, between identified needs and the available technical solutions. In this contact, much feedback and information on the functioning and experiences with certain products flow from the Assistive technology centres to the suppliers. As such, the contact with the Assistive technology centres is an important feedback channel for the producers about needs in the market as well as the quality and functioning of their products. Producers and suppliers frequently contact the Assistive technology centres and visit them to demonstrate and promote products and innovations. In a small country such as Norway, many of the actors on both sides of the table know each other well and call each other by their given names. The actors in this system describe their relations as trust based relations.

Some of out informants at the Assistive technology centres tell us that since the new instructions on non-favouring practice towards the producers/suppliers came into effect, they are not allowed to participate in seminars and workshops arranged by suppliers. It seems that there is a varied practice between the Assistive technology centres. Some of them have few restrictions on participating in seminars and workshops, other do not allow these kinds of activities anymore. Some of the professionals are very worried about this

practise because it removed an important source for knowledge and updating on what is on the market.

There is a mutual dependence between the Assistive technology centres and the producers and suppliers. The professionals at the Assistive technology centres depend on knowledge about the products from the producers and suppliers to do their job. They are constantly looking for solutions to needs they assess at the workplaces. On the other hand the producers and suppliers know that the Assistive technology centres are the main gatekeepers to the market. It is not enough to get the product into the pink catalogue; it has to be used by the Assistive technology centres. This means that the relation has to be handled carefully, but both parties are dependent on each other to provide good services and products to the users – even if the suppliers argue that they feel they are the weak part in the relation.

The AT centres' budgets are divided into two parts: an operating budget and a budget for benefits. The latter one has in principle no limits since it is related to law regulated rights. The first one, however, is rather limited. This is the budget which the AT centres use to pay for support and service from the suppliers. The AT centres are therefore often negotiating with the suppliers (and sometimes demanding) to make them include support and services in the supply contracts. To preserve a "good customer relationship", the suppliers often feel obliged to agree to such demands. There are examples of negative sanction against those who don't.

Sometimes the Assistive technology centres ask the suppliers to assist in diagnosing concrete workplace related problems and recommend solutions. However, the Assistive technology centres are eager to underscore that they always are in control of the process and never accept the suppliers' advice without checking for the most cost-efficient solution. In certain cases, the producers take a high economic risk in producing equipment for a very narrow market niche or for a small number of users at the request of the Assistive technology centres. In such cases, the product price will be high, but considered legitimate by the Assistive technology centres.

Summarising the experiences from the relation between the producers/suppliers and the Assistive technology centres we can identify the new instructions from NAV on non-favouring practice towards producers and suppliers as a potential barrier to the spread of knowledge about products and how they work among the professionals at the Assistive technology centres. This non-favouring practise may also be a barrier for creating good, adjusted solutions for the users at work places.

The relations between SIKTE and the producers/suppliers

As mentioned above, SIKTE is a national competence centre for ICT based assistive technology. Working in close contact with user needs in relation to mobility problems and combined loss of senses, SIKTE acts as negotiators between producers/suppliers and end users. SIKTE is also initiating and participating in R&D projects, national as well as international. Given their position, they are to be considered as influencers and prime movers in the innovation and diffusion of ICT-based assistive technology.

Several informants have mentioned that the know-how of SIKTE is not fully taken advantage of in relation to exploiting the potential of ICT as assistive technology at work places. Problems faced by professionals at the Assistive technology centres making as-

sessments at work places are rarely communicated to SIKTE, which may have to do with professional rivalry.

Universal design

The NGOs interviewed in this study are all occupied with advocating universal design. A better accessibility to ICT is an important issue. Nevertheless they all stress that universal design will never totally remove the need for assistive technology. One of the informants says that there is a danger that new general ICT products with available accessibility settings will make it harder to acquire the necessary assistive technology. He mentions as an example the synthetic speech available in Microsoft's operating system. This built in synthetic speech is far from as good as the available products of synthetic speech on the market. The worst-case scenario would be if blind persons did not gain access to these products anymore because the gatekeepers in NAV interpreted the available synthetic speech in the general ICT product as good enough.

Several informants stress that the main challenge and demand must be that the universal design solutions are compatible with necessary assistive technology.

Diffusion –adaptation - implementation

In this part of the chapter we are mainly concerned with accessibility to ICT and ICT-based assistive aid at the work places. The focus is on ICT and ICT-based assistive technology as a means for labour market inclusion. This part is essential for uncovering whether persons with special need actually get the equipment they need and whether ICT is fully utilized as a means to a more inclusive working life.

In the foregoing sections, we have described the different actors involved in adaptation and implementation of ICT at the work places. One of the main actors are the Assistive technology centres, but for them to succeed, and to get them involved in cases, is dependent on a demand for their competence. The demand or request could come from Work life centres involved in cases at workplaces, from occupational health services, from the local Work and welfare centres or from municipal health personnel and ergonomists. The municipal health care services are most often involved in cases where a person, upon completion of a vocational rehabilitation process, is trying to get in to working life. Of course in many cases the employee will be the person making a request if this person already is familiar with the assistive aid system. The employer could also be an important actor requesting assistance.

Knowledge about available ICT

One of our informants in a user organisation says:

> How can we believe that the employer should understand what is possible for a blind person to do with a computer. In many cases he barely knows how to use it himself, and here is a blind person.

Several of the informants say that employers have little knowledge about the possibilities within ICT and ICT-based assistive technology. In a way it is not realistic to ask that all employers should know about all available products and possibilities within ICT based assistive technology. The important factor is that they know that there exists people with competence on the issue and who to contact. One informant at an Assistive technology centre tells about a case where an employer contacted them in a recruiting process. He had two candidates, both of them well qualified for the job. One of the candidates was severely dyslectic. The employer contacted the Assistive technology centre to ask them if there was anything they could do, if there was any tools available. They did not know where he got the information about their competence; he called them on his own initiative. They told him about available programs and tools. One week later they got an e-mail saying: *"I hired him, now you have to help me!"*

Our interviews show that this is not a representative story. Employers rarely make these kinds of requests on their own initiative. Most often the system around them has to provide the employer with knowledge and expertise about what is possible. If the company is an IA-company they have an adviser at the Work life centre that they can turn to. This person should have knowledge about the competence at the Assistive technology centre and they also have the adjustment subsidy to cover the expenses of assistive aid for persons not fulfilling the terms for getting assistive technology covered by the National Insurance[41]. Another important actor for the companies is the occupational health service. In recruitment processes most often the local NAV office will be involved, and in some cases also the municipal health services. The municipal health care services are most often involved if there is a case of a person having completed a vocational rehabilitation process and trying to get in to working life.

Different users – different practices

The users in need of ICT based assistive technology could be categorised in to two groups:

- The employees / job seekers with disabilities who are known by the Assistive aid system.
- Employees / job seekers who have not earlier been in contact with the Assistive aid system, but who have needs for assistive technology / accessible ICT solutions.

The challenges concerning these two groups are different. In the one case their need of assistive technology is known, and the challenge is to assess the needs at the work place and to get the correct and adequate tools. In the other case there is a question about both identifying the needs and getting in contact with professionals who have competence on ICT and assistive technology.

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[41] Lasting (2 year) reduced functioning, illness, impairment etc.

Lack of knowledge among the actors offering services on working life and inclusion.
Thru the interviews we get the impression that there seems to be little knowledge at workplaces about what is available and possible, but more worrying is the concern about so many of the actors who are supposed to provide services directly to the workplaces in case of sickness, injuries, persons with reduced work capacity, do not seem to know about the possibilities, and maybe more importantly, do not know where to get the expertise. One of our informants at an Assistive technology centre says:

> There is little knowledge among the actors who are supposed to be the "helpers" for a higher degree of participation in working life.

One of the informants reports that she feels that many of the persons who are engaged in adjustment at workplaces are good on ergonomic tools, but have a kind of a denial relating the existence of new IC technology. This could be due to a lack of competence and experience, and a lack of belief in themselves in this area, a worry that they might not be able to make these tools work. The informant thinks that this of course also could be a generational phenomenon.

One of the informants at an Assistive aid centre is worried that the question of whether they get involved in cases concerning employees with impairments at workplaces is based on coincidence. When it comes to persons at risk of falling out of working life due to injuries or developed impairments and long periods with sick leave, there is little awareness about the possibilities in ICT and the expertise available in the NAV system. There are no systems developed for involving NAV expertise in all work life cases concerning persons with injuries and impairments. The situation will be different concerning disabled people that are in need of assistive aid and who are already inside the system. The concern about lack of contact is mainly related to persons getting injured, developing impairments and by that becoming disabled in their work situation. In many of these cases there is no explicit policy for involving the expertise from the Assistive aid system. Whether this is done or not is dependent on each consultant or service provider involved. For example, is the responsible person at the Work life centre is familiar with the expertise at the Assistive aid centre. Has the ergonomist at the occupational health service worked with persons from the Assistive aid centre before and therefore know what they can offer. The informant at the Assistive aid centre told us that she experiences that in too many cases that the contact is based on coincidence. Lack of competence and lack of communication is one of the barriers that several of our informants mention. The informant from the Centre for vocational rehabilitation (SYA) tells us that in cases where they get involved that their role is very often to get the different actors at local and county levels to work together.

Is the potential of ICT fully utilized as a means for inclusion in working life?

> The problem is not concerning the employees that we get in touch with; the problem is all the rest of them.

This statement is made by an informant at an Assistive technology centre. It seems like one of the problems is that the competence and services of the Assistive technology cen-

tres are not well enough known for all users in need of ICT tools. These employees could be persons with dyslexia that do not know that they could get a specific software program that could help them in their work situation. Another example mentioned is that of employees with injuries like back or neck ache, tendonitis etc. that make them unable to work with their computer. A lot of employees get disabled because of these injuries, but many of them never get in contact with the Assistive technology centres. One of the informants at an assistive technology centre tells about a case she was involved in.

This was a female engineer. She had developed severe problems with neck and shoulders, and with tendonitis. Her job was mainly concentrated on working at the computer, programming. Her doctor had forbidden her to use the computer; she could not use her arms and shoulder. She had been on sick leave for a long time. She had got a tip about the assistive technology centre, that there may be some computer aid that could help her. Our informant worked with this person. She was equipped with a mouse that she could operate by her head, a display keyboard, and speech recognition.

This employee was able to "work in English". This was a condition for using speech recognition as a tool because there are no available speech recognition programs for the Norwegian language that works satisfactory.

Several different kinds of devices are developed and available for controlling the computer: Mouse, switches, control panels, keyboards and scanners. It is possible to steer the mouse in many ways, for example by the head or by eye-steering of the board. You can have adaptation of keyboards with slow keys, filter keys, repetition delay etc. You can have reading list, synthetic speech, speech recognition etc. Many of these equipments could be means for employees being able to continue in their job if they get injured or develop impairments.

Adaptation and implementation at the work place

One problem that several of our informants tell us about is incompatibility problems between different soft- and/or hardware systems. Another problem is related to the development towards use of thin clients at large work places which involves the use of one central server for the whole company, with no software placed on the local machine. This is becoming more and more common. It is seen as cost effective for the company and also providies better security. The problem is that it makes the use assistive technology on this system a challenge. Some of our informants at Assistive technology centres tell us that it is possible to solve these problems, but that is dependent on establishing a good relation to the local ICT department in the company. Thru the interviews we got several examples of cases where the IT-advisor from the Assistive technology centre had been able to establish good solutions for the user, giving them access to all available programs used at the work place. A success factor in these cases seems to be that they managed to establish a good relation and cooperation with the ICT supporter at the work place. A crucial factor for being "accepted" by the ICT supporters was that the professionals from the Asssistive technology centres proved to be well qualified, that the products they used where licensed,

and a promise that the Assistive technology centres would cover the expenses and perform service on the assistive technology. We got to know about one case where it had taken almost a year to establish a good solution for a blind person in a thin client system. The barriers in this case were related to not being able to establish cooperation and understanding of the needs of the employee at the central ICT department of the company. Both the local employer and the Assistive technology centre worked together to solve the problem, but without the necessary support from the central office. Another barrier for establishing good systems seems to be lack of competence in working out specifications when companies are installing new systems.

Do employees get the ICT tools they need?

One of the informants at an Assistive technology centre tells us that there are two kinds of users. One user that is occupied with getting tools that makes him manage his job. Not asking for too much. This user is afraid of too much "fuzz" around him at the work place. At the other end is the "super-user", always up to date on what is available and always asking for new versions and the latest equipment. The latest will not always get what he or she asks for because it will not be assessed as necessary to do the job, or financially defendable.

One other informant tells us that some users are so grateful to finally be employed that they will live with not having optimal use of their equipment, or not ask for new versions or alternative equipment because they will not be a bother for the employer or simply because they do not know about available possibilities.

Our impressions from the interviews are that users in contact with the Assisitive technology centres to a large degree get the equipment they need and ask for. One of the informants at an Assistive aid centre states that they almost never say no when the case is concerning working life adjustments. In some cases there are arguments about who is to finance the equipment. The employer should finance ergonomic adjustments and equipments that can be categorized as general (ordinary) computer equipment. Larger investments, expensive assistive ICT tools and ICT solutions categorized as assistive technology are paid by NAV.

One of the informants tells us that they are very flexible when it comes to working life cases. Inclusion in working life is a national target, especially emphasized by the government and the Ministry of Labour and Inclusion. They are stricter when it comes to ICT equipment for daily life purposes.

Some of the users' organizations tell us that there is a problem with some of the centres that they have little focus on working life. Most of their work at the Assistive technology centres is about daily life, and some of the centres have little experience and knowledge concerning working life. Others are very good at it. One of the problems reported from users is that in some cases users get a decision on ICT-based assistive technology, but it could take weeks and months before the actually tools are delivered. Another barrier is that in some cases the user does not get adequate education in how to use the tools delivered. Other informants tell us that in some cases there is an argument between the Assistive technology centre and employer on who is responsible for education in use of tools.

Need a problem recognition

Thru the interviews we also recognized that there is another, fifth, part in this system of innovation, a part we could categorise as "need and problem recognition". This part in many ways goes together partly with the diffusion phase, but most certainly with the implementation phase. Different actors who provide services to employers and employees in cases of reduced working capacity or who provide the user adjustments to perform tasks at the workplace, play an important role in recognizing needs and problems. Thru assessments at workplaces, thru meetings with the employee or job-seeker, thru communication with employers and most certainly thru working with implementing ICT based assistive technology at the work place these actors have an essential possibility for recognising needs and problems. The fundamental question is whether they do, and if they do, are these needs and problems communicated to producers or milieus that can work on solving these problems and developing solutions that could answer the needs.

Innovation at the Assistive technology centres.
The role of the Assistive technology centre is to assess the need of the employee or job-seeker. Give advice on what kind of adoptions of the workplace are necessary, how these will work and find available devices. In many cases the Assistive technology centre also have technicians working with installing devices at the work places, making adjustments and trying to make solutions that work for the employees.

In these processes the people from the Assistive technology centre do a lot of what could be described as "innovative work". They uncover the needs of the user, what kind of systems and programs used at the work place and try to find solutions that make these tools accessible for the employee.

One of the problems is that these solutions not necessarily are communicated to others in the assistive aid system. Or that needs or barriers for the employee that they uncover are not necessarily communicated to expertise milieus that could work on finding ICT solutions that could break down these barriers. One of our informants says:

I have a lot of ideas, but where do I go with them?

One of the obstacles to communication of ideas is the fear of being seen in too close contact with deliverers and producers. There has been circulated new rules from NAV at the national level on being careful on contact with producers and delivers. This is a means to prevent corruption. These rules are very differently interpreted at the various Assistive technology centres. At some centres there is a very strict policy for contact with these milieus, and this constitutes a potential barrier for solving problems, but also for communicating good ideas.

Communicating ideas and needs of products.
The experts at the Assistive technology centres do from time to time also have ideas for new products with obvious commercial potential. As public servants they are however not allowed to have a business, which would conflict with the interests of NAV. According to

our informants, they sometime handle this dilemma by presenting the need or idea for the producers and leave it up to them to exploit the idea commercially. Sometimes they also produce innovations made by themselves in smaller scales for users they work with, for example small software programmes, etc.

One producer reports that he experiences that NAV has to improve their feedback practices towards the innovators and developers regarding uncovered needs among the end users, products weaknesses and areas where future developments are needed. The existing feedback mechanisms are not considered as adequate.

Barriers in the system

Figure
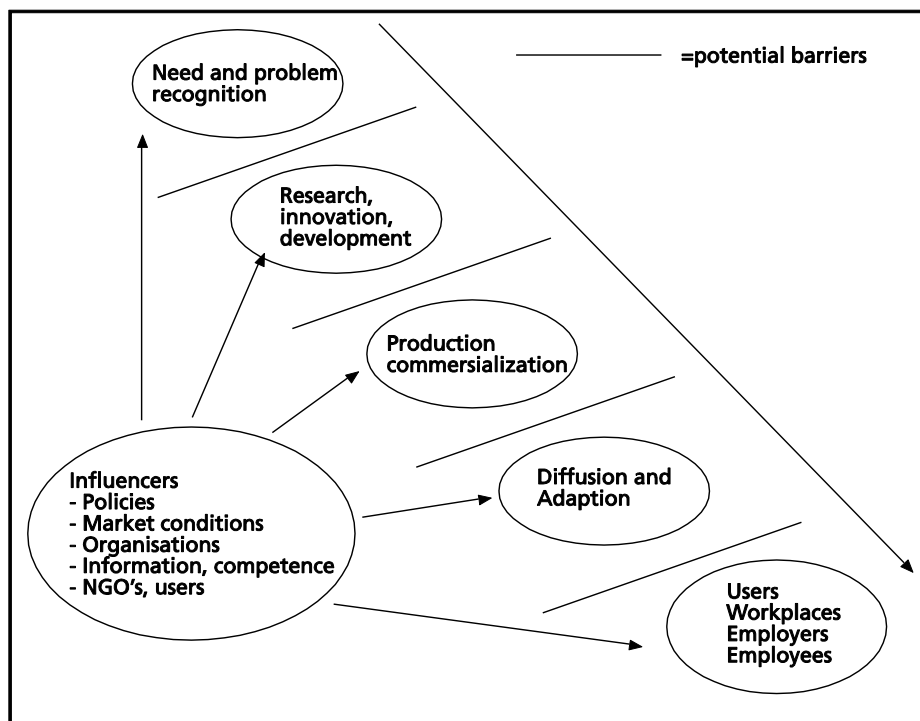
In the figure above we have tried to draw the system of innovation and how we are trying to uncover potential barriers in the system to innovation and accessibility to ICT and ICT-based assistive technology at the workplaces. The figure illustrates that there are several actors exerting influence on the system and processes, and several phases where potential barriers may hinder innovation and accessibility. The potential barriers in the Norwegian system based on our study could be summarised in three key words: Lack of *Competence, Knowledge and Communication.*

In this chapter we will systematise the uncovered potential barriers in relation to the different parts of the innovation system: Innovation, production, diffusion and implementation.

Potential barriers in different phases

Need and problem recognition – innovation: potential barriers
Knowledge about universal design / usability.
Communication of uncovered problems and needs.
Communication of ideas.
Policy for contact between NAV and innovators / producers.

Innovation – production: potential barrier
Limited financial resources for research and development.
Small companies with lack of capital to fund developing projects from innovation to commercialisation.
Few meeting places between NGOs / users and innovators / producers.
Few meeting places between NAV and innovators / producers.

Production – diffusion: potential barriers
New NAV policy restricting parallel agreements of approved products.
Time between each arranged tender by NAV.
NAV as the market
Knowledge and competence in the reference groups.
International companies demanding a certain volume to establish national distributors.
Knowledge about products at ATC.
Meeting places between ATC and producers / deliverers.

Diffusion – implementation: potential barriers
Knowledge among employers and employees
Knowledge about the competence available in the assistive technology system.
Involvement of the Assistive technology centres.
Competence about ICT solutions and products.
Communication between different actors in NAV at local on county level.

Implementation – use: potential barriers
Knowledge among employers and employees about solutions and expertise.
Cooperation between local ICT supporters and professionals from the ATC.
Responsibility for financing
Training in use of the ICT solutions.

Chapter 4. The United Kingdom

Architecture of the diffusion system in United Kingdom, with particular reference to visual impairments

By Darcy Hill, Nigel Meager and Sally Wilson, Institute of Employment Studies, UK.

Aim of this paper

The aim of this paper is to explore the UK system of innovation and diffusion of ICT used to assist disabled people in remaining in and entering the labour market. It describes the various actors involved in these processes, the working relationships between these actors and the different factors at play that prevent and/or support technological advancements and applications of ICT developments in UK in the aforementioned context. It is important to emphasise that this review is intended be an illustrative rather than a comprehensive account of the UK diffusion process. Given the vast range of assistive ICT on the market and the diversity of the disabled workforce who obtain benefit from them, for practical reasons, some constraints have been applied to the scope of the review:

Instead of covering the full spectrum of disabilities and impairments, we have chosen to concentrate on visual impairment as a case-study, and we focus on ICT and assistive technologies used by the sight impaired and blind populations (*Annex 2 provides some background statistics on these groups in the UK*). Therefore processes and actors involved in the use of ICT by individuals with other types of impairment (hearing, cognitive or mobility) are not covered here in detail.

The review interprets "UK actors" as "actors based within the UK". This is an important constraint, given the extent to which international (and in particular, US) actors within the private sector impact on the UK ICT market.

In order to examine the diffusion process in detail, four distinct processes are considered, namely innovation, production, distribution and implementation. This paper is structured according to these four phases. In Part 1 we describe the various actors involved in the system, according to sector, and the processes in the system that they engage in. In Part 2 we analyse the relations between these actors and barriers in the system that have been identified through the interviews conducted.

The paper is based on a review of relevant policy documents and industry websites. The information presented also draws on semi-structured expert interviews conducted with a small number of key informants among relevant NGOs and private sector companies[42].

The paper comprises the second stage of an internationally comparative project covering, in addition to the UK, Norway, Denmark and the Netherlands.

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[42] The interviewees are listed in Annex 1.

Actors in the UK diffusion system

This section of the paper describes the main UK actors in the diffusion of ICT in the context of enabling disabled people to enter and remain in the labour market (throughout, we focus particularly on the situation as it applies to blind and visually-impaired people). Where possible, each actor is linked to a particular stage or stages of this process; namely:

innovation

production

distribution

use and implementation

Since many actors are involved in more than one of these processes, one-to-one mapping between actor and activity is not always possible. Also it is important to bear in mind that the source material (documents, websites, expert interviews and informal discussions) used to determine the function of individual organisations may not necessarily reflect "behind the scenes", yet important, aspects of their role.

The primary aim of this section is to provide some context to some of the collaborations that are described in the next section in detail. Many of the organisations cited here are able to make a tangible impact on the diffusion and innovation processes only through collaboration with other agencies: this applies particularly to some of the smaller NGOs, who play only a supporting role in innovation and diffusion activities.

In Annex 3 we provide a 'map' of the various actors and their relationship to each of the four stages of the diffusion process (at least as it applies to ICT for blind and visually-impaired people), as observed through our literature review and the small number of interviews with key actors. Table 1 briefly summarises our assessment of the relative importance of each of the four types of actor in each of the four stages of the diffusion process (more details of the role of each type of actor are then given in the remaining sections of this chapter:).

Table 1: the role of the key actors in the different stages of the diffusion process

	Innovation	Production	Distribution	Use/implementation
Government	✓		✓✓	✓
NGOs	✓		✓✓	✓✓✓
Universities/research organisations	✓✓✓	✓		
Private sector	✓✓	✓✓	✓✓✓	

Government

Generally speaking, most of the processes contributing to diffusion of ICT among working age disabled people are not directed by the UK Government. The government's main role in this area is provision of funding through its "Access to Work" scheme, intended to support disabled people in entering and remaining in the labour market. There are also

several government bodies whose regulatory responsibilities impact (albeit indirectly) on the use and implementation of ICT.

During the autumn of 2007, the UK Government made several changes to its various ministerial Departments and their responsibilities. Therefore new administrations are still in a process of clarifying their objectives and priorities, and the extent to which new institutions will replicate the functions of old ones is largely unknown. The information presented here reflects the situation as represented in government documents and websites during the latter part of 2007.

Innovation

The state does not have a direct role in stimulating innovation in ICT for disabled people, nor in promoting universal (otherwise known as inclusive) design. There are several potential mechanisms for government financial support: in particular resources channelled through the UK's research councils are used to support innovation across a wide range of disciplines impacting on a range of social and health-related needs. At present, however, the ICT needs of working people with disabilities is not listed as a priority area.

Department for Business, Enterprise and Regulatory Reform (BERR)

The new Department for Business, Enterprise and Regulatory Reform[43] (BERR), which largely replaced the previous Department of Trade and Industry (DTI), is the ministry responsible for

> "creating the conditions for business success, developing deeper and more effective engagement with business, and with the ability to promote the competitiveness agenda across critical areas of Government policy".

There are no initiatives at present within this department directed at developing innovation in the areas of assistive technology or ICT. In contrast to its predecessor, the Department of Trade and Industry (DTI), this department has no jurisdiction over the UK's state-funded research councils. However it is the intention that BERR will work closely with the new Department for Innovation, Universities and Skills (DIUS), which has now assumed this role.

Department for Innovation, Universities and Skills (DIUS)

The Department for Innovation, Universities and Skills[44] is responsible for co-ordination of the Government's science and technology related activities and policies and administers the distribution of some £2.4 billion amongst seven UK Research Councils. This means that DIUS are involved in deciding whether certain broad areas of science or activities should be given priority, how much money should go to each Council and indeed whether there should be a particular Council at all

The science and technology remit of this new department replicates that of the former Office of Science and Innovation (OSI)[45], which previously operated as part of the former DTI. DIUS is also responsible for the further and higher (i.e. university) education sectors.

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[43] www.berr.gov.uk

[44] www.dius.gov.uk

[45] http://www.theyworkforyou.com/wrans/?id=2007-10-29b.151382.h

Previously, these policy areas were administered by separate Government departments. This move to bring the two areas together is consistent with a general move within the UK to encourage universities to exploit opportunities to generate income through research and innovation (through what is often termed "third stream" activities[46]).

The Engineering and Physical Sciences Research Council (EPSRC)

Each year the UK Research Councils[47] invest around £2.8 billion in research covering the full spectrum of academic disciplines from the medical and biological sciences to astronomy, physics, chemistry and engineering, social sciences, economics, environmental sciences and the arts and humanities.

The policy framework for the Research Councils is determined by Government in the Comprehensive Spending Review, and more specifically in the Science Budget, which sets broad priorities between several classes of activity. However the Government has no involvement in deciding actual programmes of research or thematic areas beyond some broad priority setting. Neither does it have any influence over which organisations or which research projects receive funding. The Councils are expected to set their own policies.

There are seven research councils in total: the most relevant of these to ICT research and development is the Engineering and Physical Sciences Research Council[48] (EPSRC) which serves as the main UK government agency for funding research and training in engineering and the physical sciences. It invests around £500 million a year in a broad range of subjects from mathematics and materials science, to information technology and structural engineering. The Council aims to "meet the needs of industry and society by working in partnership with universities to invest in people and scientific discovery and innovation". Their work is intended to be complementary to other research investors including other research councils, government agencies, industry and the European Union. The work of the Council involves partnerships and collaborations across disciplines, and international boundaries. They also serve to promote public engagement in science, engineering and technology.

At present EPSRC do not independently fund any projects specifically addressing the ICT requirements of the disabled working age population, although the i-design project, described in Part 2 of this document is highly relevant to this area. Also, none of its current research calls are of direct relevance, although proposals submitted in response to the New Dynamics of Ageing[49] research call – a cross research-council initiative involving four of the other research councils – invites proposals for technological solutions in relation to age-related disabilities.

Technology Strategy Board

The new Technology Strategy Board[50] was established as an executive Non-Departmental Public Body in July 2007. Its "vision" is for the UK to be seen as "a global leader in innovation and a magnet for technology-intensive companies, where new technology is applied

[46] http://www.hefce.ac.uk/reachout/

[47] www.rcuk.ac.uk/

[48] www.epsrc.ac.uk

[49] http://newdynamics.group.shef.ac.uk/

[50] http://www.berr.gov.uk/innovation/technologystrategyboard/

rapidly and effectively to create wealth". It has several innovation "platforms". One of these is entitled "Assisted Living[51]", but it is not geared towards the labour market. Instead its aim is to make significant advances in the technology needed to enable people who suffer from chronic long term conditions to live independently.

Distribution/Use & Implementation

There is no public sector involvement in the production or manufacture of ICT, but some government organisations have involvement in the distribution and implementation processes. The main government actor in the latter group of processes, as far as disabled people and the labour market are concerned, is the Department for Work and Pensions (DWP) which provides funding for equipment through its Access to Work programme.

Department for Work and Pensions

Access to Work (AtW), which has been described in detail elsewhere in the first stage of the current project[52] is intended to enable disabled workers to access the necessary and appropriate assistive technology for their jobs via Access to Work Business centres, administered by JobCentre Plus (the name of the UK's public employment service). As previously described there are no accurate data available on the specific types of ICT that it enables disabled individuals to access.

A key part of the AtW process involves an advisor or a technical consultant making an individual assessment of needs, sometimes by specialist AtW assessors. However these assessments are more frequently provided by agreed upon contractors, usually from NGOs, although private companies are also involved in this process. The scheme also has a role in ICT use and implementation since, as well as funding specialist workstation assessment, it also funds related training for the employee.

Another element of the frontline services for disabled people provided by Jobcentre Plus is the network of Disability Employment Advisers. These are based locally and provide a range of support, advice and information to disabled job-seekers, including the provision of information and the arrangement of assessment and employment. They can also offer a route to the WORKSTEP programme, which takes a proactive role in helping people to enter the workplace through supported employment (in contrast, AtW tends to concentrate on individuals already in mainstream positions in the labour market or who are about to enter such positions, and the restriction of AtW to people who already are in such a position is commonly seen as one of its main limitations in facilitating the entrance of more disabled people into the labour market). In some cases WORKSTEP funding is used for workplace adaptations including assistive technologies, although as with AtW, the extent to which this impacts on overall UK distribution is unknown.

Department of Health

The Department of Health in the UK does not have responsibility for distributing equipment in the context of employment, but it is leading a pilot of the new system of Individ-

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[51] http://www.3cresearch.co.uk/item/88/23/5/3

[52] Meager N, Wilson S, Hill D , ICT Strategy, Disabled People and Employment in the UK, IES Working Paper WP14, March 2007 http://www.employment-studies.co.uk/pubs/report.php?id=wp14

ual Budgets[53] for social care beneficiaries (some of whom, but by no means all will also be disabled), a cross-government project also involving the Department for Work and Pensions, the Office for Disability Issues (ODI) and the Department for Communities and Local Government.

The aim of Individual Budgets is to give people more choice and control over the services they use. The budgets included in this project will cover disability equipment and home adaptations, social care services and also the type of workplace-related support offered by Access to Work. Disabled people and other social care beneficiaries will be able to choose to take a direct payment and buy their own services, to have the services that the local council offer or to have a mixture of both. Individual Budget pilots started in December 2005 and depending on how the testing goes, the Government will decide whether or not to introduce Individual Budgets nationally.

Office for Disability Issues

The Office for Disability Issues[54] (ODI) provides the focal point within government to coordinate disability policy across all departments. Its main remit is to take forward the Life Chances Report[55] to ensure robust implementation of its recommendations. The report concerns quality of life issues for disabled people and but does not mention of the role of technology in enabling employment.

Use and implementation

The organisations listed in this section are primarily concerned with enforcing regulations that link to ICT only indirectly. However there is some (albeit limited) potential for the activities of these bodies to impact on the use and implementation of ICT by disabled employees, through their influence on employers and ICT providers.

Equality and Human Rights Commission

The Equality and Human Rights Commission (EHRC), created in April 2007, operates as an independent statutory body serving to eliminate discrimination, on the grounds of gender, age, race, religion/belief, sexual orientation as well as disability. In doing the latter it serves to enforce the Disability Discrimination Act – DDA, (described in some detail in the Module One document) and replaces and incorporates the previous UK Disability Rights Commission (DRC), which has now been wound up.

The most recent DDA provisions (which came into force in 2004) place a legal requirement on the providers of goods and services to make their facilities accessible to their customers with disabilities. However, as with the rest of the provisions of the DDA there is an obligation only for "reasonable" adjustment, and therefore encourages low-technology solutions that remove physical barriers to work. While there is some evidence that the work of the former DRC has impacted on web design, it remains to be seen whether recent legislation has encouraged uptake of specialist ICT equipment in the workplace.

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[53] http://individualbudgets.csip.org.uk/index.jsp

[54] http://www.officefordisability.gov.uk/

[55] http://www.cabinetoffice.gov.uk/upload/assets/www.cabinetoffice.gov.uk/strategy/disability.pdf

Ofcom

Ofcom (the Office of Communications)[56] is the independent regulator and competition authority for the UK communications industries. It was established as a "body corporate" by the Office of Communications Act 2002 with responsibilities across television, radio, telecommunications and wireless communications. Strictly speaking Ofcom is independent of Government, but as a statutory corporation, it is required to report annually to Parliament.

As the UK's communications regulator, Ofcom has a number of duties designed to ensure that disabled people have fair access to electronic communications, as set out in Ofcom's Disability Equality Scheme[57]. These include setting and monitoring targets for television access services (subtitling, audio description and signing) and encouraging the avail-availability of easy to use equipment. In television it regulates the text relay service, which enables deaf people and hearing people to communicate with each other. Ofcom also works with telecom providers to make new and existing telecom services and technology accessible to disabled people.

A range of relevant consumer reports has been produced by Ofcom, (e.g., "People with hearing impairments and communications services"[58]) although there are no data available at present to evaluate the impact of Ofcom on technological innovations for people with disabilities.

Non-Governmental Organisations (NGOs)

There are many hundreds of charities and voluntary organisations that serve the interests of disabled people in the UK. Even when we restrict our analysis to those offering services to visually impaired people alone it is not possible to determine how many offer services and support in relation to assistive technologies.

The scale of NGO activity related to blindness and visual impairment in the UK is huge. At one end of the spectrum there are just over 800 registered charities for the blind and visually impaired with income under £100,000 a year and a combined income of £8.6 million. At the other end, there are just six such charities each with an annual income over £10 million, with a combined income of nearly £290 million.

Smaller groups rely on national charities to use their influence to achieve the best possible outcomes in public policy and legislation. And national charities often rely, in turn, on these grassroots organisations to deliver the day-to-day activities, which plug the local gaps in public services.

Larger national bodies have the profile to influence legislation and public policy. Collaborating from similar positions of strength, they have the opportunity to effect changes in what government proposes. The Royal National Institution of Blind People (RNIB) is the actor in the sector and has a wider-reaching role than any other of the NGOs described here. It is the UK's leading charity dedicated to helping anyone with a sight problem. As well as leading high-profile campaigns it is a key player in the provision of expertise and support services to workers with visual impairments.

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[56] http://www.ofcom.org.uk/

[57] http://www.ofcom.org.uk/consult/condocs/des/

[58] http://www.ofcom.org.uk/research/tce/ce07/annex5.pdf

RNIB's campaigns and other activities are not specifically oriented towards employment issues. RNIB's work has, for example, a strong emphasis on the technologies that deliver talking books – with arguably stronger implications for education and leisure than for employment.

Innovation

Two NGOs that make their role in innovation explicit in their marketing and publicity are described here. However the role of many NGOs in innovation is not transparent: some of the organisations described in the next section (involved in distribution and the use and implementation) may also be carrying out some innovation work, however.

RNIB

The RNIB Product Design Consultancy is the part of RNIB that is explicit about its work with other organisations to promote innovation. This unit is able to link innovators with user groups in order for them to receive feedback. Despite its role within RNIB, it operates much like a profit-making consultancy, and works with designers and manufacturers to improve the design of products and services to make them more inclusive.

Activities include market-targeted user-testing where it has access to RNIB's extensive, nationwide network of people with sight problems and older consumers. It is actively involved in pushing forward the inclusive design agenda and is involved in a number of collaborative projects described in subsequent sections of this paper.

The Foundation for Assistive Technology

The Foundation for Assistive Technology (FAST) exists to promote research into ICT and other assistive technologies, to ensure that product development reflects user needs, and to build partnerships between users, manufacturers and service providers. In this sense FAST, although a very small organisation with limited resources, is one of the few players in the UK that plays this bridging role between the innovation, distribution and implementation stages of the system. FAST argues (see discussion on its website) that a number of factors limit the uptake of new assistive technologies in the UK. These include a lack of collaboration and information sharing amongst researchers and developers and limited consultation with users of assistive technology, manufacturers and service providers during the development process.

Distribution and Use/Implementation

There are several NGOs whose activities influence the processes of distribution and use/implementation, but their level of involvement in these processes is difficult to quantify. Many act as signposting organisations, directing users to recommended suppliers and/or products. However it is not clear how employment-oriented these activities are.
A sample of the organisations that offer this type of service is listed here as there are too many to document in full. In relation to sight impairment, RNIB is the most influential.

RNIB

RNIB is the dominant NGO involved in conducting activities that contribute to the distribution of equipment for blind and visually-impaired people. There are RNIB Regional Resource Centres across the country where a range of ICT products are available to view and purchase. These provide local support to help people with sight problems to obtain

the best education and employment opportunities. The RNIB website also features an Online Shop which supplies a range of equipment. These centres also impact on use and implementation. Some ICT training is available at the centres, but users must pay for this.

Much of RNIB's activity in this field is related to provision of information, such as the RNIB Technology Information Service. This service provides advice and information on the types of technology that are used in the workplace. RNIB also produces guideline documents such as 'See it Right' which provides information about the use of Braille and audio information in technology and how common software packages, such as Word and Excel, can be used by the visually impaired. RNIB also runs the Web Access Centre, a commercial consultancy service, which carries out website accessibility audits for organisations.

AbilityNet

AbilityNet is a charity providing free information and advice, and individual assessment of technology needs for disabled people, as well as consultancy for employers on system and workstation adaptations and web accessibility. It makes a contribution to distribution in the sense that its charitable activities include helping disabled people source value for money equipment. Also, some of its income is generated from assessments it undertakes as a contractor for private clients and statutory bodies: through these activities it has a role in ICT use and implementation. It has established links with Microsoft, IBM, Hewlett Packard, BT and other major IT companies, which "put us in a very strong position to make sure the voices of disabled people are heard". Some of these companies provide AbilityNet with support by giving them office space and/or equipment and software but is not clear how active these links are or whether AbilityNet makes any real contribution to innovation.

British Computer Society Disability Group

This is a subdivision of the British Computer Society (BCS), the leading professional body for those working in IT. It has over 60,000 members in more than 100 countries and is the qualifying body for Chartered IT Professionals (CITP).

The BCS Disability Group focuses on the use of ICT in facilitating opportunities for people to reach their full potential by breaking down barriers to accessibility, social and digital inclusion. It has several objectives. Those most directly relevant to diffusion are:
to identify shortfalls in the general provision of services and equipment for disabled people and to initiate projects in order to correct such situations;

- to inform and support ICT developers on inclusive design;

- to encourage the computing and communications industries to consider the needs of disabled people at the design stage; and

- to offer a forum to stimulate new IT developments in this field.

It also offers professional input into national government consultations. It is not clear how active this group is in working with commercial partners.

Ability Magazine

Ability Magazine is a campaigning publication for people who have difficulty using IT. It is aimed at those who buy, run and use accessible systems. In each issue Ability Magazine provides a detailed review of products, techniques and skills required to deliver systems for users who find it difficult to use standard software and hardware.

Originally published by the British Computer Society's Disability Group, Ability magazine aims to promote an inclusive society that rests on the enabling possibilities of technology. The magazine has developed from an in-house newsletter into a widely available magazine circulated to users, IT managers, human resources professionals and those who work in the disability field. Its sponsors include BT and Microsoft UK.

British Computer Society for the Blind

BCAB is an organisation of visually impaired people who use Information and Communications Technology (ICT). Their members range from experienced computer professionals to people who are beginning to explore the use of ICT for leisure, study or employment.

Activities include "holding discussions with international software developers about the impact of their products" and their commercial members include Dolphin Computer Access, Humanware and the Force 10 Company.

Ricability

Ricability[59] is the trading name of the Research Institute for Consumer Affairs (RICA). It is a national research charity, providing independent information of value to disabled and older consumers. Under its trading name of Ricability, it undertakes research and publishes consumer reports, which provide practical information needed by disabled and older consumers.

In the guise of RICA it works with manufacturers, service providers, regulators and policy makers to improve products and services. Its aim is to increase awareness of the needs of disabled and older consumers through specialist research. However a Ricability/RICA representative confirmed that the activities of their organisation have not, to date, focused on ICT equipment or software with workplace applications.

Leonard Cheshire (Workability)

Leonard Cheshire[60] is a small UK charity that provides a range of services including the Workability[61] programme, which supports the needs of disabled people who are seeking employment.

Leonard Cheshire has recently been awarded a grant from Microsoft UK to develop three regional community-based IT training centres[62]. This grant will provide fully accessible computer rooms and equipment in a positive environment for people with disabilities to develop IT skills.

The Foundation for Assistive Technology

As noted above, FAST also has a role both in innovation and in use/implementation, and one of its objectives is to act as a bridge between the two elements of the system and *"get users actively involved in the design and provision of assistive technology solutions"*. In practice, however, it is a relatively small organisation with limited resources, and the bulk of its activities relate to the provision of information and training. Currently FAST devotes much of its resources to tackling the lack of education and training for AT practitioners and are work-

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[59] www.ricability.org.uk

[60] http://www.lcdisability.org/

[61] http://www.lcdisability.org/?lid=1044

[62] http://www.lcdisability.org/?lid=709

ing in collaboration with skills bodies to promote professional development in assistive technology and develop a nationally recognised competency framework in this area.

Private sector

UK actors in the private sector are largely confined to those distributing and marketing products produced overseas. As might be expected in an English-speaking nation, manufacturers in the US dominate the market. The larger of these tend to have bases in the UK that serve as a point of contact for marketing and technical support (and therefore do not carry out domestic research and development activities). For this reason there is limited scope for specialist assistive technology companies based in the UK to engage in innovation. Also foreign manufacturers can influence the distribution and use/implementation processes through UK traders.

Innovation

It is difficult to estimate the scale and progress of relevant innovations taking place in the UK, since many will arise from applications of products originally developed for mainstream use. Examples of innovations of this type include BT Text[63] and the Seeing Eye Phone[64], which uses technology developed by Innovision Research and Technology[65]. Microsoft UK publicises its partnerships with RNIB but it is nevertheless hard, from external sources, to assess the extent to which R&D on accessibility for disabled people takes place within Microsoft's UK arm.

Production

There is limited private sector production of assistive ICT for blind and visually impaired people within the UK: Dolphin Computer Access Ltd[66] appears to be the only major player. Dolphin's products are aimed at allowing visually impaired people to access mainstream applications in their original form. It works closely with Microsoft and exports to more than thirty countries, despite a small worldwide workforce of around sixty people. Dolphin products include screen enlargers, screen readers, and Braille output, which enable users to operate word processors, spreadsheets, databases, and the Internet. Dolphin also produces: text-to-speech software; Braille translation software, and text reading software, and claims to have the widest range of software tools for the visually impaired market in the UK. One third of its annual gross revenue is re-invested in design and development. In December 1999, Dolphin purchased Labyrinten, a talking book company and works with them to produce a range of audio publishing tools and talking book readers. This primarily serves the education and recreational markets.

In order to provide some broader context, a sample of ICT producers encountered in the research for this paper, whose products are aimed at assisting users with visual im-

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[63] http://www.btplc.com/age_disability/phoneservices/products/textphone/BTtextpayphone.htm

[64] http://www.innovision-group.com/case_study_view.php?casestudyID=3

[65] http://www.innovision-group.com/contact.php

[66] http://www.dolphinuk.co.uk/

pairments, are listed below. Although all are distributed in the UK, as can be seen, none are directly produced in the UK.

Nuance Communications[67]: a US company whose products include Dragon speech recognition software (these can be bought direct from Nuance UK[68])

AI Squared[69]: a US company: Ai Squared has been a leader in the assistive technology field for 18 years. The company's flagship product, ZoomText, is magnification and reading software for the vision impaired.

Ash Technologies[70]: based in Ireland, this company manufactures portable products for partially sighted persons.

Enhanced Vision[71]: based in the US, Enhanced Vision is a leading developer of assistive technology such as digital magnifiers for the visually impaired.

Humanware[72]: a US company producing assistive technologies for vision, including low vision aids and Braille machines

Code Factory/ONCE Cidat[73]: a Spanish company who are "committed to the development of products designed to eliminate barriers to the accessibility of mobile technology for the blind and visually impaired".

Optelec[74]: based in the Netherlands, and claiming to be the world's largest specialist in electronic equipment for the blind and partially sighted.

Reinecker[75]: based in Germany and producing opto-electronic reading devices for visually impaired and blind people.

Distribution

There is a profusion of small distributors retailing assistive technology for disabled users: by way of illustration a search of *yell.com* (internet business directory) in the UK reveals nearly two thousand businesses whose description matches the term "Disability Information and Services". Of these businesses it is not possible to determine how many retail high-technology products, which of these do not specialise in visual impairments nor indeed how many operate within the private sector. None of the distributors identified in the research for this paper concentrate specifically on employment-related ICT solutions for the workplace, and most are offering assistive technologies for disabled people to use in their daily lives.

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[67] www.nuance.com

[68] http://www.nuance.co.uk/company/

[69] http://www.aisquared.com

[70] http://www.ashtech.ie

[71] http://www.enhancedvision.com

[72] http://www.humanware.com

[73] http://www.codefactory.es

[74] http://www.optelec.com

[75] http://www.reineckerreha.de/

According to FAST[76] the most comprehensive source of information at national level on commercially available products and retailers is the Disabled Living Foundation's database. The database, DLF Data[77], covers a wide range of products and includes a description, key features, price guide and links to retailers and manufacturers to enable purchase. There are 25 categories of product in total, including "Office furniture and equipment". At present this is available only by subscription. Although access to the online database is available to disabled people at a discounted rate, FAST comment that this is "prohibitively expensive" and are actively campaigning for this resource to be made freely available to individual consumers, as is the case in France, Germany, the Republic of Ireland and many other comparable European nations. It is also worth stressing that DLF is a 'knowledge management service' targeted mainly at older people and their carers. Its dominant focus appears to be on relatively low-technology, domestic equipment, such as bath harnesses and stair lifts[78]. It is not targeted at employers at all, or indeed at disabled people looking for workplace-related solutions.

For illustrative purposes, examples of some of the larger UK distributors specialising in high-technology solutions for users with sensory impairments are listed below:

Sight & Sound Technology

Sight & Sound Technology[79] claims to be the leading supplier of equipment to blind and visually impaired people within the United Kingdom. It supplies technologically advanced equipment and software for the blind and visually impaired to meet the diverse spectrum of individual needs. It serves as the exclusive UK distributor for Ai Squared (producers of ZoomText), Freedom Scientific, (MAGic, JAWS) and other international software development companies. It emphasises that its product range reflects a commitment to continual product refinement and innovation

Techready

Techready[80] sells assistive technology products aimed at a broad range of visual impairments. TechReady emphasises that because "assistive technology" is all about making things easier to use, it has mainstream applications. Techready is AbilityNet's "preferred supplier.[81]"

Force 10

Force 10[82] specialises in Sensory Loss & Hearing Loop systems. It started trading in 1967, and since 1989 has become a major supplier of Low Vision Aids and Assistive Hearing products for those with visual and hearing impairments.

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[76] http://fastuk.org/atforumactivities/informationavailability.php

[77] http://www.dlf.org.uk/professional/dlfdata/dlfdatacategories.html

[78] The emphasis of the products disseminated through DLF can be seen on the website – http://www.dlf.org.uk/public/factsheets.html

[79] www.sightandsound.co.uk

[80] www.techready.co.uk

[81] http://www.abilitynet.org.uk/atwork_at

[82] www.forcetenco.co.uk/

Use & implementation

The main actors that influence use and implementation of ICT in the workplace in this sector are small consultancy firms, individual assessors and NGOs, which are contracted by Jobcentre Plus to provide assessments for Access to Work recipients. There is no publicly available register of approved assessors on either a local or national level. Some of the organisations outlined in previous sections of the paper above also operate as AtW assessors under contract to Jobcentre Plus; AbilityNet, for example, is one such assessor.[83]

Research centres and universities

There is no mechanism for co-ordinating or systematically capturing the role of research centres and universities in innovation and/or production of ICT for disabled people in the workplace.

Much activity consists of individual researchers developing new technologies with potential applications, which may benefit disabled users. In some cases this occurs with funding through research council grants or from government departments.

The research for this paper did, nevertheless, identify several research teams based in universities engaged in individual and collaborative activities in this area:

Engineering Design Centre, University of Cambridge

The Cambridge University Engineering Design Centre[84] incorporates the Inclusive Design, Accessibility and Rehabilitation Engineering Group and is based within the Cambridge University Engineering Department. Research activities encompass many areas of ergonomics; human-computer interaction and product design, from the design of product interfaces to the development of mechatronic assistive devices. With the support of the EPSRC they have developed the Inclusive Design Toolkit, which was commissioned by BT, with major inputs from Sagentia[85] (a Cambridge based consultancy) and the Helen Hamlyn Centre at the Royal College of Art. The *i-design* programme[86], from which it originates, is described in more detail in another section of this paper.

Helen Hamlyn Centre, Royal College of Art

Another *i-design* partner, the Helen Hamlyn Centre[87] is a multi-disciplinary centre for inclusive design. The Centre is made up of a team of designers, engineers, architects and anthropologists who undertake practical research and projects in partnership with industry. Its programme looks at how a socially inclusive and human-centred approach to design can support independent living for ageing and diverse populations, improved standards of healthcare and patient safety, and innovation for business. It works in response to a commitment in the Royal College of Art's Charter to "advance learning, knowledge and professional competence" in relation to "social developments" and engages a range of external commercial, academic, government and voluntary sector partners in its work.

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[83] http://www.abilitynet.org.uk/atwork_access

[84] http://www-edc.eng.cam.ac.uk/noticeboard/46a0c5971fcb

[85] http://www.sagentia.com/

[86] http://www-edc.eng.cam.ac.uk/idesign/

[87] http://www.hhrc.rca.ac.uk/

Centre for Usable Home Technology, University of York

The Centre for Usable Home Technology88 brings scientists together from the Computer Science, Electronics and Psychology departments at the University of York. CUHTec's aim is to ensure that future home technologies meet real social and personal needs by working in collaboration with users, especially older and disabled people. It also brokers partnerships to implement the requirements in mainstream products. The Centre has received the support of the Tunstall Group89 (a healthcare technology company), Hewlett-Packard Laboratories, and Microsoft Research. As indicated by its title, the Centre's work is not employment-focused and is principally oriented towards independent home living.

Applied Computing, University of Dundee

Applied Computing90, based at the University of Dundee seeks to determine how computing and information technologies can enable people to gain access to facilities, services, devices, and information that is otherwise unattainable. Its contributions to research have included innovative ways to alleviate the effects of dyslexia and interactive cognitive aids for memory loss that enable three-way communication between user, carer, and system via mobile technology. It also runs an associated accessibility research consultancy, the Digital Media Access Group, which promotes the design of accessible and useable Web sites and other digital information. Digital Media Access Group clients include Yahoo and Scottish Power.

Rehabilitation Resource Centre, City University

The Rehabilitation Resource Centre (RRC)[91], which was established in 1984 at City University in London, is a leading UK research, training and consultancy centre on employment and disability. The Centre aims to improve the employment and training opportunities of people with disabilities. It aims to "bridge the gap between theory and practice" and maintains strong links with employers and service providers

As an example of its work in ICT accessibility, in 2006 Ofcom commissioned City University[92] researchers to examine the feasibility of widening the availability of video relay services for British Sign Language (BSL) users.

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88 www.cuhtec.org.uk/

89 http://www.tunstall.co.uk/

90 http://www.computing.dundee.ac.uk/ac_research/projectdetails.asp?id=41

91 http://www.city.ac.uk/sonm/rrc/

92 http://www.addrelay.org.uk/index.htm

Key issues in the diffusion of ICT to disabled workers in the UK

Having explored some of the key actors in the supply of ICT for disabled workers, this section goes on to discuss some of the cross-cutting and key issues affecting the ways in which the actors work together (or not - in some cases), to deliver innovative ICT solutions to disabled workers.

As with the previous sections of this paper, this section focuses primarily on visual impairments. However, many of the issues are equally applicable to other types of impairments. It is based on a small number of interviews with experts at key non-governmental organisations and in the private sector, and considerable desk-based research and Internet searches.

Lack of national framework

The 'architecture of diffusion' in the UK is a term, which suggests a greater level of organisation and intention than currently exists. This is largely the result of an absence of a national framework, which would otherwise stimulate activity in the areas of innovation, production, distribution and implementation. As discussed in the UK paper for the first module of this study[93], the UK does not have a national ICT strategy, nor does it have a policy or strategy with regard to 'inclusive design'. There is also no national approach to regulating or standardising the provision of assistive technology[94] (apart perhaps from website accessibility, which could arguably be considered as an implied requirement of the goods and service provisions of the UK's Disability Discrimination Act).

Despite an absence of steer from government, there is a drive towards embedding the principles of inclusive design into product design and development through a multi-organisation partnership project called *i~design*. Having established clear objectives relating to the promotion and application of inclusive design to UK product developers, the project has already succeeded in establishing a British Standards document on inclusive design management (BS7000-6)[95] as well as creating a toolkit with design cards for product developers to use in considering the capabilities of the UK population as a whole. Whilst the focus of this inclusiveness drive is on improving usability of *all* products for an ageing population, as opposed to specific applications for the employment of people with disabilities, the initiative is nonetheless unique in addressing this aspect of accessibility and innovation in the UK.

The project is a collaboration between the private sector, NGOs, and research centres based both in UK universities and in the private sector. Over thirty UK-based companies

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[93] Meager, Wilson and Hill, 2007, op. cit.

[94] AT is separately funded for 'independent living', employment, education and training (student access grants), but there is no national approved list of technologies that can be funded.

[95] For more information about British Standards see link: http://www.bsi-global.com/en/Standards-and-Publications/About-standards/

have been involved, including the BT Group, Royal Mail, B&Q, and Tesco. NGOs represented include the RNIB, the Design Council, and the Royal Society for the encouragement of the Arts (RSA). The main driving force behind this collaboration however, appears to come from the research centres, and four university-based research groups. Two private sector research/design consultancies are also involved[96].

Assistive Technology versus Universal Design

At the core of the discussion of the supply of ICT for disabled people (for use in employment or for daily living) is the distinction between assistive technology and inclusive design. The majority of tools and solutions enabling people with visual impairments to make use of ICT in the UK are assistive technologies, which have been developed to bridge a gap in function. Because the solution is a 'retrofitted' adjustment, each time the main ICT product is moved forward (as with new editions of operating systems, or new technology functions incorporated into standardised equipment) the AT solution must also be redesigned or readjusted. The retrofit approach of AT brings with it several implicit barriers for disabled users.

First, is the fact that the AT supply chain is operating in parallel to mainstream ICT production and will, therefore, always and inherently be delayed in gaining access to the latest developments in ICT function. Second, the AT solution will inevitably generate greater costs: because it operates in tandem to the mainstream ICT production, additional time and resource must be spent through design, marketing, training, and support. And third, as both mainstream and AT producers and consumers become established in achieving accessibility through retrofit solutions, the potential for universal design and usability is undermined by a lack of demand.

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[96] For more details on the research centres and private and voluntary sector partners, see section on Private sector and Research centers and universities of this paper, and the map of actors (Annex 3).

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Microsoft compatibility or Apple integrated models?

One example of this paradox between assistive technology and inclusive design, although not exclusive to the UK, is the different approaches taken by two leading operating systems, Microsoft and Apple. Screen-readers, a technology which converts text to speech, are one of the main tools used by blind computer users enabling access to both hard and soft text (with use of scanners and other technology), and reducing the need for Braille translations.

There was a big change to the AT industry for screen-readers in 1996 when Microsoft created the MSAA certification, which enabled software developers to create applications which work in tandem with the MS operating system. Whereas previous screen-readers had to make 'guesswork' about how to translate various images and blocks of data on the screen, and which to prioritise, the MSAA certification enabled certified screen-readers to interrogate the MS operating system. This resulted in considerable improvements in function, but is still essentially an improved method for retrofitting assistive technologies. Apple, on the other hand, have developed their own technologies for screen-reading and include this in their PC package. Our interviewee at RNIB[97] argues that this works better, as it creates a seamless interface. It also reduces costs across the spectrum for ICT production: innovation, production, distribution, and implementation are streamlined, resulting in cost savings at each stage.

Whilst Microsoft would argue[98] that they are creating and enabling a market eco-system for software developers to innovate and meet the needs of users with additional access requirements, the development costs for assistive technologies are a greater burden for small- and medium-sized enterprises than they would be for Microsoft. These costs, along with the additional resource put into marketing, training, and product support, are eventually passed to the end user, in addition to purchasing the basic equipment and operating system. Apart from cost, the Microsoft model also limits the scope for innovation as the certification process ensures that software applications function in a consistent and compatible format.

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On the basis of the evidence available to us, we would argue that the dominant emphasis in the UK system appears to be on the development of Assistive Technology (that is to say, the design and production of specific products and technologies which aim to improve accessibility for disabled and older people), rather than on universal/inclusive design, which would focus on ensuring that all 'mainstream' products and technologies incorporate features which make them accessible without the need for separate Assistive Technology[99]. This does not mean that the work on AT is not relevant to universal design; clearly it is, because AT innovations may in some cases influence mainstream design, but it is still the case that the main focus in the fragmented UK system seems to be on AT rather than universal design. Indeed it may be that it is the very fragmentation of the UK system,

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[97] Steve Tyler, RNIB head of innovation

[98] According to Steve Tyler, ibid.

[99] See also the relevant discussion in "Inclusive design or assistive technology", A. F. Newell, Inclusive Design for the Whole Population (2003) (Eds. J. Clarkson, R. Coleman, S. Keates and C. Lebbon), Springer, pp.172-181. ISSN: 1 85233 700 1, and Hitchcock D, 'Is Inclusive Design ready to Improve Employment Opportunities?" Journal of Occupational Psychology, Employment and Disability, Volume 6, Number 2, Autumn 2004 , pp. 75-78(4).

with no clear national strategy, legislative or policy framework underlying the development and provision of ICT to disabled people, and the multiplicity of uncoordinated actors involved which gives rise to an emphasis on AT rather than universal design. A key question for the comparative aspect of the study will be whether the more structured, co-ordinated approach with a stronger state framework in some of the other (especially the Nordic) counties facilitates a greater emphasis on universal design.

Limited range of activity from partnerships

The majority of inter-organisational activity identified for this research was being undertaken between NGOs and large companies in the private sector. There were also a few projects identified which involved collaboration between NGOs, the private sector and universities/research centres. In both cases, the NGOs appeared to provide the essential link to disabled users, representing users' needs, circumstances, and views. Whilst the types of activity undertaken range from awareness-raising at one end of the spectrum, to actual innovation and production at the other, the majority of activity stemming from partnerships appears to be dominated by awareness-raising, and general promotion of accessibility issues to businesses in their roles as employers (rather than in their roles as producers of ICT).

Private sector – NGO collaboration

One example of a relationship between the private sector and an NGO, is the working relationship between BT (British Telecom) and RNIB. The rationale for the partnership appears to be a combination of corporate social responsibility and research and development objectives, which together are argued to help broaden the business into specialist markets whilst also capturing the benefits of inclusive design for all customers. One of the collaborations of BT with RNIB has been to develop telephone design, improving usability amongst blind and partially-sighted users with the BT *Big Numbers Hands-free Phone*. The phone is produced by BT and is sold in BT shops, as well as being marketed to blind and partially-sighted customers via RNIB's website[100]. BT has also been actively engaged in improving usability and accessibility to their services through a range of other NGOs supporting different types of disability.

Other examples of NGO and private sector collaboration include:

- The Employers' Forum on Disability offers a venue for large businesses to discuss and promote disability issues in and around the workplace. The focus here is on 'enabling' disabled employees through improved accessibility (although this does not generally have a specific ICT focus), with an emphasis on awareness-raising and presenting the "business case" for disability to employers. Recently, EFD has been taking a more explicit stance on accessible technology issues, and importantly is campaigning from a business perspective for ICT providers to develop assistive and accessible technology for disabled people in the workplace (in early 2008, EFD launched a new Business Taskforce on Accessible Technology[101]).

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[100] http://onlineshop.rnib.org.uk/display_item.asp?n=11&c=27&sc=141&id=3152&it=1&l=3&d=0

[101] http://www.employers-forum.co.uk/www/press-and-media/2008/03/business-leaders-call-for-accessible-technology.html

- Lottery funds awarded to the British Computer Association to run awareness raising events for people with visual impairments, demonstrating low cost access methods such as speech software. This illustrates the role of NGOs in promoting use of ICT/AT to disabled consumers.

Innovation is a central priority for the RNIB, and can be demonstrated by the fact that the business model has been designed to fund these activities. Income from commissioned and commercial services are used to fund research and development. Because existing AT is very costly (in terms of purchase, installation, training, and support) innovation is required to reduce cost and increase the effectiveness and usability of technology solutions[102]. Their objective is to move towards socially-sustainable innovation: this incorporates good usability with financial feasibility.

- University – private sector collaborations. The main other category of partnerships generating activity in the area of innovation were those which involved private research centres and universities (with and without contribution from NGOs). Based on the examples of work identified to date, it would appear that these collaborations are the ones most likely to lead to steps towards universal design (e.g. the *i~design* project: see section 0 above) although activity is still largely working on promoting the principles of inclusive design and raising awareness.

- Also worth mentioning (although not specifically focusing on disability and employment issues) is the Alliance for Digital Inclusion, which is dominated by the UK divisions of multinational private sector organisations (key members include AOL, BR Cisco Systems, IBM, Intel, Microsoft and T-mobile), which promotes inclusive design principles and works with NGOs and innovation consultancies to promote the 'e-inclusion charter' and to influence government on issues relating to social inclusion and ICT.

Government intervention emphasising Assistive Technology rather than Universal Design

Whilst this section started by observing the lack of a national framework for innovation, this is not to say that the government is inactive in helping disabled users access ICT. In addition to anti-discrimination legislation (DDA) and web accessibility standards (both explored in the previous module[103]) the government indirectly influences the architecture of diffusion, particularly through the *Access to Work* (AtW) programme.

The delivery of this programme can also be seen to represent the government's main interactions with other actors in the system, through the supply and delivery of assessments for *Access to Work*. Private and voluntary sector organisations provide their expert knowledge of disability and assistive technology to deliver assessments of needs, as well as training and support. Organisations are contracted through a supplier framework, and advisors in the regional Access to Work business centres refer to the framework suppliers to match applicants' circumstances with relevant disability and AT specialties.

The government also influences innovation indirectly, through research funding councils such as the ESRC and EPRSC. There are a few examples of the government regulating

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[102] RNIB interview with Steve Tyler.

[103] Meager, Wilson and Hill, 2007, op. cit

elements of inclusive design, but according to one source[104], these regulations occur after the innovations have been taken up by mainstream suppliers and are following trends in usability, rather than leading. Examples cited include the '*dot 5*' which enables visually-impaired users to locate a central point on a number key pad (on phones and banking machines), and the availability of banking templates in alternative formats such as Braille, large print, and in audio.

International collaboration

Whilst the focus of this research is on actors and issues exclusive to the UK, it is of relevance to understand the extent to which UK activity is linked with international actors. Innovation for ICT products appears to exist at an international level, with UK businesses working closely with other European businesses. Production and distribution processes are also international: one UK AT retailer described the UK assistive technology production industry as non-existent[105]. AT hardware and technology are sourced from countries such as Korea, and Taiwan, although there is limited understanding of the nature of these exchanges or transferrals of technology.

Other factors impacting on the international nature of the UK AT supply include language. Being an English-speaking country has enabled transfer of technology and products from North American markets direct to the UK. Whilst large American-owned producers of ICT have UK offices, very little actual innovation, product development, or production appears to be based in the UK.

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[104] Interview with Steve Tyler, Head of Innovation, RNIB, October 16th 2007.

[105] Norman Lilly, Force 10.

Seeing-eye Phone

Only one example was identified through this research of multi-organisation partnership in high-tech innovation in the UK, which also happens to extend to an international level through high-tech R&D networks. Innovision Research and Technology[106], a UK-based firm, developed the Topaz tag, which uses Near Field Communications (NFC) technology. This technology has been adopted by a Finnish company, VTT Technical Research Centre, to be used in the development of their 'Seeing-eye-phone' application. Both NFC and the Topaz tag have universal design in mind, as the technology is designed to assist visually impaired consumers, or tourists to a foreign country, whilst shopping for items in stores.

A Topaz NFC tag, containing a product identity code and a web-link to a server providing product specific information, is affixed to the shelf edge adjacent to the relevant product. As the consumer holds their NFC-enabled phone up to the tag corresponding to the desired product, information including price, nutritional data, use-by date and special offers is retrieved from the server database. Rather than being displayed on the screen, this information is converted to speech by the phone's built-in text-to-speech synthesiser, and played to the consumer through the phone's speaker in the user's own language. The technology has equal potential to retrieve bus times or other poster information from servers to be converted to speech.

The technology gained international recognition through winning a European-wide competition, of NFC innovations, which took place in April 2007 in Monaco. Sponsors included Nokia, Innovision Research & Technology plc, SmartTouch and the NFC Forum, and is designed to promote innovation and excellence in NFC service implementations throughout Europe. Since winning the "Touching the Future" competition, VTT has had a request from a national blind people's association to develop the application for blind and visually impaired people at home, enabling users to differentiate between products of a similar size and shape, such as regular and decaffeinated coffee.

Barriers and 'sub-optimalities'

It is clear that in the UK, disabled users' access to ICT is mainly enabled through the use of assistive technology and, less often, through the use of universal design. Some of the reasons for this have already been mentioned, for example the different approaches taken by Microsoft and Apple, or the lack of a government framework on ICT strategy or innovation. Beyond these, there are additional processes at work, which continue to undermine the development and incorporation of inclusive/universal design principles into new ICT products.

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[106] Company website: http://www.innovision-group.com/index.php

Innovation

The existing model of development and provision is heavily dependent on large NGOs (e.g. RNIB) using their charitable activities and commercial services to subsidise innovation and research and development in AT. Funding for this is limited.

At the same time, some interviewees argued that innovation for disabled consumers is a 'niche activity', which tends to occur only in mature/saturated markets. Key ICT products (computers, mobile phones, electronic goods) are sometimes not yet at that stage of saturation. Another argument posed is that mainstream ICT products are developed very quickly, and incorporating accessibility (either through inclusive design or compatibility) is seen as a burden to production speed.

Manufacturers' understanding of the 'centre of the market' is, however misinformed by what Steve Tyler describes as a break in the 'feedback loop'[107]. Because there is no way for manufacturers to register non-purchases, the unmet consumer demand is not quantified. Non-purchases, in this respect, refer to the number of times a consumer walks into a shop looking for a particular type of product (for example, a new type of technology which meet their access needs), but is unable to find what they are looking for. As producers only capture feedback when a product is sold, it sends a message back to the manufacturers to make more of what is selling.
The resulting marketing strategies…

> *"that people who don't buy function-rich products are not interested, when in fact they may be put off by usability issues"[108].*

As a result, usability is sidelined.

Production

The Microsoft operating system encourages growth of specialist software firms designing AT applications to be compatible with Microsoft systems. This approach is associated with greater overall costs, both for businesses and consumers: more frequent updates are required, as well as more detailed training and support mechanisms to integrate external applications.

Distribution

The broken 'feedback loop' also impacts on distribution, as mainstream producers and retailers are not convinced of the size, value, and benefit of the potential market for distributing specialist and integrated technologies.

The bias towards external applications over integrated solutions is further exacerbated by limited awareness of existing integrated solutions. For example, despite the RNIB Head of Innovation acknowledging the success of Apple personal computers having integrated screen-readers, these products are not promoted on the RNIB website alongside equivalent external applications.

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[107] Interview with Steve Tyler, RNIB.

[108] According to Ofcom report 'Ease of use issues with domestic electronic communications equipment', reported in Ability Magazine, Iss.67, 2007.

Specialist retailers not advertising directly through NGO websites face an additional challenge reaching their target audience because of the implicit access barriers associated with visual impairments.

Implementation & Use

The detailed knowledge and experience required to support the use of AT means that it is unlikely that existing technologies are being utilised to their full potential. In the overall system of diffusion, this understandably shifts the focus away from innovation, as visually impaired users need to master the potential of what currently exists (not just the technologies, but understanding the potential of the internet, and then the basic interface of computers). This point is borne out by a high rate of return of AT equipment provided through AtW (this return rate was reported by one of our interviewees to be as high as 30 per cent in the first six months after provision of the equipment).

Government funding for AT focuses on those already in work, or applying for a job, or in the education system: this creates an paradoxical situation in funding provision as the people who need AT the most are often not eligible for funding (those not in work or in education). Access to AT needs to start well before entry in to the labour market, because an individual's full potential is unknown without a good understanding of and familiarity with the AT available to support them.

Concluding remarks

In this final section we attempt to summarise our findings in a way that addresses six key questions, which will form the basis of the comparative study with the other three countries being examined in the research.

Who participates in the diffusion system?

Looking at the system of innovation, production and diffusion of ICT used to assist disabled people in remaining in and entering the labour market (with particular emphasis on our case-study group of people with visual impairments) we can identify five key groups of actors with different and overlapping roles in the system.

Government

The Government's role is relatively limited in most stages of the diffusion process. There is no national strategy for stimulating the innovation or diffusion of ICT for disabled people or on the promotion of universal/inclusive design, although government has an indirect role in innovation through its support for the universities and research councils (see below). The main role of government is in the distribution/implementation stages, particularly through the Access to Work programme which finances a range of support (including ICT) to enable disabled people to enter and/or remain in employment. In addition government has a role providing financial support for social care (through the National Health Service and local authorities), which may include assistive technology for older and disabled people, but this is much more targeted on 'independent living' than on labour market access for disabled people. Finally, although there is no explicit state promotion of the universal/inclusive design approach, the government has indirect influence in this area through the implementation and enforcement of the Disability Discrimination Act (which places duties on employers and goods and service providers to make workplaces and a wide range of goods and services accessible to disabled people) and through regulation of the communications sector.

NGOs

NGOs are very important in the UK system. They have a modest role in the innovation stage, but a significant role in the distribution and implementation stages.
We can distinguish between two main types of NGOs for the purposes of this study:

What we have called 'impairment-specific' NGOs. These are organisations of or for particular groups of disabled people. There are over 800 of these in the UK with a focus on blindness or visual impairment, but a very small number of large scale ones which have a strong role in ICT provision (the RNIB is particularly dominant here)

A range of voluntary and charitable organisations whose focus is not on particular impairment groups, but on the development or distribution of assistive technologies for

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disabled or older people: in particular we have noted the important roles played by the Foundation for Assistive Technology (FAST), and AbilityNet, but other relevant organisations are also identified in the main text of the article.

Both types of NGO are involved in assessment of ICT and other support needs of disabled people in the workplace, through their roles as contracted assessors to the government's Access to Work programme.

Universities and research organisations

There are a number of important initiatives by research centres and universities many working in collaboration (with each other, with NGOs and with the private sector) in the development and design of ICT solutions for disabled people. This is also the main group of actors who have an explicit concern with issues of inclusive design. In the study, we have in particular noted groups undertaking relevant work at the Universities of Cambridge, York, Dundee and City University, as well as the Royal College of Art.

Private sector companies

The private sector has a key role in the production and distribution of ICT for disabled people. It became clear from the research that for the most part, the private sector's role in production takes place outside the UK (particularly in the USA) or through multinational companies, although there is a small number of UK-based specialist producers. There is a large sector of private sector distributors of ICT for disabled people, and some private sector specialists also play a role in assessment for the government's Access to Work programme.

Users

And finally, of course, are the disabled employees and potential employees, as well as their employers, who make use of the ICT in the workplace. The Labour Force Survey tell us that, in the UK, there are around 112,000 working age people with a long-term disability whose main impairment is "a difficulty in seeing"; only 53,000 of these (47 per cent) are actually in work, and most of the reminder (41,000) are economically inactive and not currently seeking work. On the employer side, there is no robust survey evidence on how many employers employ visually-impaired people, and what adjustments are made for them.

What characterises the (system of) co-operation between these actors

Our key finding here is that there is nothing that can be described as a coherent or integrated 'system' of co-operation, linking the various actors in the UK, and the various stages (innovation, production, distribution and implementation) of the diffusion process. While there is a multiplicity of bilateral partnerships and multilateral collaborations between different groups of actors (some of which we have tried to exemplify in the paper), the overwhelming impression is one of fragmentation and lack of coherence in the system. In part, this reflects the lack of a single national strategy or policy framework in this area, with a set of regulations and funding streams that would 'shape' the system of co-

operation between the actors. It is notable that in the part of the system where there is a governmental approach, with funding attached – the Access to Work (AtW) programme – this is the area where there is also a clear set of processes and co-operation, notably through the relationship between the state (through the regional structure of Jobcentre Plus, which is responsible for administering the Access to Work programme), the NGOs and private contractors who deliver assessment services for AtW, and the employees and employers who use and implement the adjustments and support provided by AtW funding.

Within the fragmented system there are, nevertheless, examples (detailed in the paper) of collaboration, for example between the private sector and NGOs (in innovation, production and distribution of ICT) and between universities and the private sector (in innovation and design).

What characterises the role of national or local authorities?

The key role of the state has been described in 0 above, and the relationship between state and other actors in 0.

How do non-public actors in the diffusion system assess the role of the public authorities?

This question is hard to answer on the basis of the evidence available to us. The fragmentation of the overall system was mentioned by many of the non-public actors as a problem. However, although more funding for support of the diffusion process was seen as desirable, it was not clear that a higher level of and more proactive state intervention to regulate and control the system would be desired: although the multiplicity of actors and lack of clarity about who is responsible for what can be seen as a barrier (see 0 below), the variety of players in the UK system (particularly the NGOs) and their closeness to the users can also be seen as giving a degree of choice and responsiveness to the system, which might be lacking in a more centrally-driven system.

As far as the Access to Work programme is concerned, which is the main way in which the state authorities intervene in the system, it will be necessary to wait for the publication of the forthcoming evaluation of AtW (later this year) for an up-to-date assessment of other actors' views of AtW. On the basis of previous work, however, it is clear that AtW is generally viewed in a very positive light by disability and user organisations – the main criticisms have been related to a) its scale – it reaches only a small proportion of potential users and employers; b) related to this, the relative lack of awareness of the programme, and the lack of marketing of it to employers (this reflects funding constraints in government); c) concerns about the length of time it can take between a need being identified, and the support being supplied (this is particularly important if the support is critical to a disabled individual being hired by an employer); d) the fact that support is available only to disabled people who are already in work, or who already have a job offer (rather than people who are simply looking for work, or thinking about entering the labour market).

How do producers of ICT adapt to the demand for universal design?

This is also a question that is not fully answerable from the evidence gathered for module 2.

- First, producers of ICT were not themselves part of the study so we did not obtain direct evidence from them.

- Second, as we note in the text in previous sections (see especially section 0), it is not clear that there is a strong 'demand' for inclusive or universal design in the UK. The current model, which we observed through the research, is very much dominated by assistive technology solutions being 'retrofitted' to mainstream ICT applications, rather than being driven by an approach of universal/inclusive design.

- Finally, although some innovation and design does take place in the UK, particularly in the universities and research centres, some of which (like the *i-design* project) do have an interest in universal design, it is not clear that these have yet fed into the activities of mainstream producers of ICT in any major way.

What barriers or bottlenecks can be identified in the system?

As discussed in section 0 of the papers, the research highlights a number of barriers or bottlenecks in the system. In particular:

- The over dependence on the role of a small number of NGOs and the lack of large-scale private or public sector funding for innovation, research and development in this area.

- The lack of effective feedback loops for communicating the needs of disabled users to innovators and producers.

- The dominance in ICT of multinational producers such as Microsoft, and the need for specialist firms designing AT solutions to subordinate their designs to be compatible with Microsoft, leading to extra costs, and a continuing need to update as Microsoft systems themselves update.

- Poor communication channels to retailers and distributors to ensure they are aware of what ICT already exists for disabled people, and what the potential market for these.

- Lack of training and support for disabled users even to use the existing technologies, which in turn means that the focus is not on innovation but on struggling to use existing equipment and solutions.

- Constraints in the government's Access to Work programme (scale, awareness and eligibility, in particular)

Annex 1: interviewees

We are grateful to the following, who were interviewed for the study:
- Carol Pollitt, Principal Manager Digital Accessibility (RNIB)

- Steve Tyler, Head of Innovation (RNIB)

- John Lamb, Editor (Ability Magazine)

- Rory Heap and Jackie Driver (Disability Rights Commission – since October 2007, now part of the new Commission for Equality and Human Rights)

- Keren Down (FAST)

- Andrew Day (Ricability)

- Richard Parnell, head of research, Scope (NGO for people with cerebral palsy)

Informal discussions were also held with representatives of the following organisations attending the "Techshare" traders event held in London on 4-5 October, 2007:
http://www.rnib.org.uk/xpedio/groups/public/documents/code/public_rnib004057.hcsp

- British Computer Society Disability Group

- IT-Can-Help network

- Microsoft UK

- Force 10 Assistive Technology Solutions

- Ability Magazine.

Annex 2: Background statistics on visual impairment and the labour market

The table below presents Labour Force Survey data on the incidence of different types of main impairment among disabled working age people in Great Britain. It shows that of, the 6.9 million working people with a long-term disability (i.e. who meet either the DDA definition of disability or the LFS work-limiting definition or both), 112,000 or 2 per cent, cite difficulty in seeing as their main impairment. Looking at their labour market experience, the key feature, like many other groups of disabled people is the level of employment disadvantage recorded by people with visual impairments. Whereas the employment rate of disabled people as a whole is 50 per cent (it is 80 per cent for non-disabled people according to the LFS), among those with mental health conditions it is only 47 per cent. Consistent with this the proportion of people with visual impairments dependent on state

benefits and not in work is 36 per cent, compared with a figure of 35 per cent for all disabled people (and 4 per cent for non-disabled people).

The numbers of visually impaired people recorded in other data sources are rather larger than those recorded in the Labour Force Survey, for two main reasons:

- the LFS data refer to people who regard a difficulty with seeing as their 'main' impairment, and therefore exclude large numbers of visually-impaired people with other impairments

- the LFS data are confined to people of working age (16-64 for men, and 16-59 for women), and the incidence of visual-impairment increases dramatically with age. Thus the RNIB[109] estimate that there are some 2m people in the UK with some visual impairment, of whom 85 per cent are over 65. Official registration data (which pick up more severe visual impairments) show that 378,000 people in the UK are registered as blind or partially-sighted, and RNIB research suggests that one in four of these have not received any equipment at all in the last two years to help them with their day-to-day lives.

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[109]http://www.rnib.org.uk/xpedio/groups/public/documents/PublicWebsite/public_researchstats.hcsp

Table: Employment and unemployment rates by main type of impairment: Great Britain, Apr–June 2006
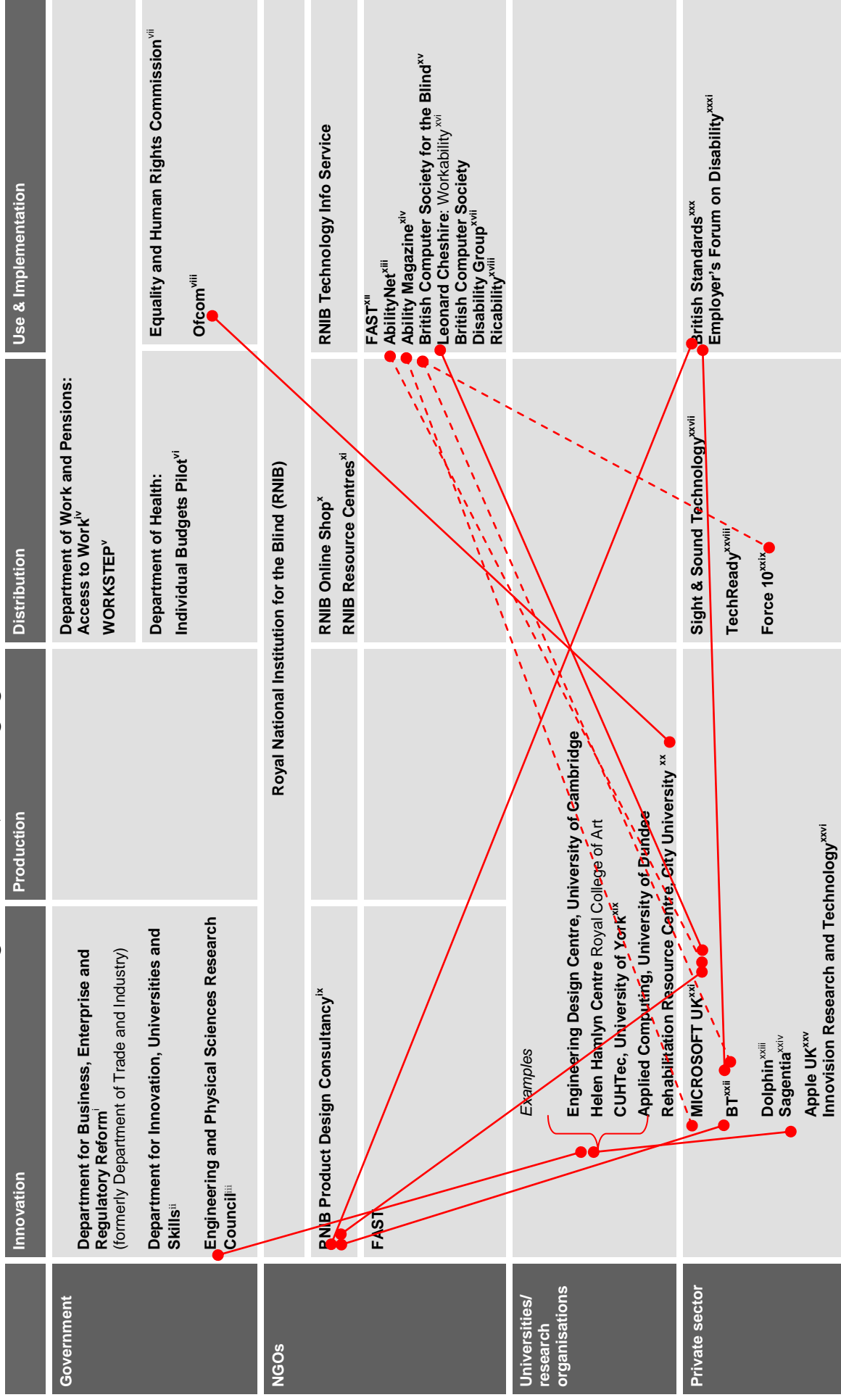
Thousands and per cent

	Number with this as main disability (% of all disabled)	Number in employment and employment rate (% of total)	ILO unemployed and unemployment rate (%)	Number on state benefits and not in work (% of total)
All long-term disabled in GB	6,871	3,465	336	2,425
	19	50	9	35
Problems with ...arms, hands[1]	397	205	16	137
	6	52	7	35
	775	356	34	319
...legs, feet	11	46	9	41
...back, neck	1,085	532	52	407
	16	49	9	37
Difficulty in seeing	112	53	*	41
	2	47	14	36
Difficulty in hearing	108	68	*	22
	2	63	*	20
Speech impediment	*	*	*	*
	*	*	*	*
Skin conditions, allergies	102	73	*	12
	1	72	*	12
Chest, breathing problems	762	490	42	162
	11	64	8	21
Heart, blood pressure	787	465	23	211
	11	59	5	27
Stomach, liver, kidney, digestion	363	220	18	88
	5	61	8	24
Diabetes	415	282	15	68
	6	68	5	16
Mental illness	680	146	43	450
	10	22	23	66
Epilepsy	146	64	*	68
	2	44	10	46
Learning difficulties	179	42	26	107
	3	23	38	60
Progressive illness n.e.c.[2]	329	123	*	163
	5	37	*	50
Other problems, disabilities	586	328	28	166
	9	56	8	28

Annex 3: Main UK actors in relation to ICT for sight-disabled, working age adults

The diagram overleaf provides an overview map of the key actors involved in the innovation, production, distribution and use of ICT as it relates to people with visual impairment in the UK, as described in the present paper, and illustrates some of the relationships between them.

Main UK actors in relation to ICT for sight-disabled, working age adults

	Innovation	Production	Distribution	Use & Implementation
Government	Department for Business, Enterprise and Regulatory Reform[i] (formerly Department of Trade and Industry)		Department of Work and Pensions: Access to Work[iv] WORKSTEP[v]	
	Department for Innovation, Universities and Skills[ii]		Department of Health: Individual Budgets Pilot[vi]	Equality and Human Rights Commission[vii]
	Engineering and Physical Sciences Research Council[iii]			Ofcom[viii]
NGOs		Royal National Institution for the Blind (RNIB)		
	RNIB Product Design Consultancy[ix]		RNIB Online Shop[x] RNIB Resource Centres[xi]	RNIB Technology Info Service
	FAST			FAST[xii] AbilityNet[xiii] Ability Magazine[xiv] British Computer Society for the Blind[xv] Leonard Cheshire: Workability[xvi] British Computer Society Disability Group[xvii] Ricability[xviii]
Universities/ research organisations	*Examples*			
	Engineering Design Centre, University of Cambridge Helen Hamlyn Centre Royal College of Art CUHTec, University of York[xix] Applied Computing, University of Dundee Rehabilitation Resource Centre, City University[xx]			
Private sector	MICROSOFT UK[xxi] BT[xxii] Dolphin[xxiii] Sagentia[xxiv] Apple UK[xxv] Innovision Research and Technology[xxvi]		Sight & Sound Technology[xxvii] TechReady[xxviii] Force 10[xxix]	British Standards[xxx] Employer's Forum on Disability[xxxi]

Established working relationships ●—●
Evidence of informal links ●- - -●

[1] http://www.hhrc.rca.ac.uk/archive/hhrc/plain/outputs/dtisurvey.html

[2] www.dius.gov.uk

[3] www.rcuk.ac.uk

[4] www.jobcentreplus.gov.uk/JCP/Customers/HelpForDisabledPeople/AccesstoWork/

[5] www.jobcentreplus.gov.uk/JCP/Customers/Helpfordisabledpeople/Workstep/index.html

[6] www.individualbudgets.csip.org.uk

[7] www.equalityhumanrights.com/en/Pages/default.aspx

[8] www.ofcom.org.uk

[9] www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_prodesign.hcsp

[10] www.onlineshop.rnib.org.uk/

[11] www.rnib.org.uk/xpedio/groups/public/documents/PublicWebsite/public_resourcecentre.hcsp

[12] www.fastuk.org/

[13] www.abilitynet.org.uk

[14] www.abilitymagazine.org.uk

[15] www.bcab.org.uk/about-us.html

[16] www.workability.org.uk

[17] www.bcs.org/disability

[18] www.ricability.org.uk

[19] www.cuhtec.org.uk

[20] www.city.ac.uk/barts/rrc

[21] www.microsoft.com/uk/about/people.mspx

[22] www.edc.eng.cam.ac.uk/idesign/partners/

[23] www.keytools.co.uk/software/dolphin_default.asp

[24] www.sagentia.com/

[25] www.apple.com/uk

[26] www.innovision-group.com

[27] www.sightandsound.co.uk/

[28] www.techready.co.uk

[29] www.forcetenco.co.uk

[30] www.bsi-global.com/

[31] www.employers-forum.co.uk

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