

ICT for Social Inclusion and Equal Opportunities: CETI-D, an e-Governance Good Practice in Brazil

Danilo Piaggese

*Fondazione Rosselli Americas,
Alexandria, USA
danilo.piaggese@fondazionerosselli.it*

Walter Castelnovo

*Department of Theoretical and Applied Science
University of Insubria, Como, Italy
walter.castelnovo@uninsubria.it*

Linamara Rizzo Battistella,

*Sao Paulo State Secretariat for the Rights of People with Disabilities
Sao Paulo, Brazil
linamara.battistella@sp.gov.br*

ABSTRACT

In this chapter we discuss a Knowledge Economy based approach to the inclusion of persons with disabilities (PwD) that, different from the traditional “assistance” model, considers PwD as active and valuable members of the present Knowledge Society, to be included in the active workforce. This approach will be discussed with reference to a specific operational case study concerning the establishment of the Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) conceived by Fondazione Rosselli Americas and being implemented by the State of Sao Paulo in Brazil.

In the first section of the chapter we discuss the problem of the inclusion of PwD as a further aspect of the digital divide phenomenon. In the second section the principles of the United Nation Convention on the Rights of Persons with Disabilities are presented and some international best practices concerning the social inclusion of PwD are introduced. In the third section we discuss the CETI-D initiative, with the aim of showing how ICT can represent a powerful tool for social and economic inclusion. Finally, in the fourth section we discuss the conditions under which the experience of the CETI-D can be replicated in other countries, with a specific focus on less developed countries.

KEYWORDS

Persons with Disabilities, Social inclusion, Knowledge Economy, Knowledge Society, E-Governance, ICT, Assistive Technologies, New Development Paradigm

INTRODUCTION

People with disabilities represent approximately one sixth of the working age population globally; this raises the problem of how this substantial part of the potential workforce can be made productive and be included within the active population. ICT represents a powerful tool that can be used to foster the social inclusion of people with disabilities (PwD), when used within a broader approach of a knowledge society. In today's knowledge society and related knowledge economy, no one anywhere in the world can actually be excluded from the use of ICT and digital interfaces. Globally, in 2008, there were 1.9 billion people with access to a personal computer at home, 1.7 billion Internet users, 4.9 billion people with access to a TV at home and over 4.6 billion mobile subscriptions. The situation in Brazil is not different. In Brazil, in 2007, there were 29 million people with access to a personal computer, 63.6 million Internet users, 113.4 million mobile subscriptions, and 36.9 million telephone land lines. These figures are increasing by the day in very large proportions. That means that in any corner of the world today, there are digital interfaces changing the lives of people, making them more productive and giving them access to a new information society. It is not a rich country paradigm, it is a universal paradigm. The pervasiveness of digital technologies and digital interfaces increases the risk of social and economic exclusion for those that cannot access and/or use them. People with disabilities are among those for which this risk is highest (Goggin & Newell, 2003).

In 2006 the United Nation adopted the Convention on the Rights of Persons with Disabilities (CRPD, 2006) to foster the social inclusion of PwD. Article 9 of the Convention defines accessibility in a very strict fashion. Article 9 actually elevates access to ICTs on a par with access to the physical environment and to transportation. It means that, for instance, a webmaster has as much obligation to make a website accessible as an architect has an obligation to put a ramp at the appropriate physical access to a building. This has immense consequences because many ICT interfaces are inaccessible today. In effect, almost half of the articles which are non-procedurals of the CRPD have some form of ICT accessibility obligation. There are a number of application areas considered in the CRPD. Some of them are specific articles of the convention, such as e-government, media and Internet, education, employment, political rights, emergency services, cultural life and leisure, private sector services, personal mobility, rehabilitation. All those sectors of application have mandates for accessibility or reasonable accommodation or for promoting assistive technologies in different cases.

PwD have specific needs – transportation, communications, medical attention, public services, among others – of whose provision the whole society is responsible, not only the State. In addition to the public sector accessibility provisions that a state must undertake, the CRPD also mentions that a ratifying state must ensure that private entities that offer facilities and services to the public take into account the accessibility of those services. That also includes ICT accessibility. This means that a ratifying state has to make sure that any digital interface or any services, whoever delivers them, have to be accessible. Accessibility is a pre-requisite for social inclusion and ICT accessibility is the condition that can turn ICT from a potential cause of exclusion into a powerful tool of social and economic inclusion of people with disabilities within the active labor force and, therefore, in the present knowledge society. PwD have specific capabilities and specialized knowledge revealed by scientific research and empirical evidence, associated to the need to compensate for lost senses, limited mobility or other impediment. Through social inclusion, PwD can make significant contributions to today's knowledge society and knowledge economy, as their specific capabilities - currently underutilized in the absence of means to make practical use of them – could become very useful.

As observed by Miller, Parker and Gillinson (2004), the role of PwD as innovators can and should be active. PwD should be included in the design process because they are good at it. There are two reasons given for this expertise of PwD in design. First, PwD are often outstanding problem solvers because they have to cope with their life, often a series of challenges to be overcome. Second, innovative ideas are more likely to come from people who have a new or different visual angle on old problems (Miller, Parker & Gillinson, 2004, p. 57). Greater participation of PwD in all aspects of technology innovation in the short term may just be the necessary trigger for creating a different, and better, system of innovation

for everyone in the future (Miller, Parker & Gillinson, 2004, p. 58). The economic benefits of such an approach could be considerable, not to mention the implications for innovation and productivity. Increasing existing systems of participatory design, could introduce new user-driven approaches into strategically important places in the design processes of ICTs for all people (and possibly in the national innovation system).

In another vein, research and development work in the area of producing accessible technology products has the potential to place accessible and affordable ICTs (and assistive technologies – AT) in the hands of millions of people who currently may not be involved in the burgeoning knowledge economy. Table 1 below roughly estimates the "proforma" size of the population of PwD in Brazil who could be impacted by policy, program, and research which emphasizes ICT and AT accessibility or affordability. This was done by assuming an equal penetration of each category of device of the Brazil population among specific groups of PwD (ideal outcome targeted by the CRPD). For example, at the intersection of mobile cell phones and permanent difficulty to hear, it is possible to estimate the number of persons possibly deprived of cell phone access by multiplying the national penetration of ICTs over national population (i.e., estimated to be 180 million for 2007) by the number of people who have permanent difficulty to hear.

Table 1. Number of PwD in Brazil possibly deprived of access to ICT (numbers in 000s (ITU, 2007))

Target Population	Telephone Land Lines 36,900	Mobile Phones 113,400	Internet Users 63,600	Personal Computers 29,000
Some or great permanent difficulty to see	3,432	10,546	5,915	2,697
Some or great permanent difficulty to hear	1,107	3,402	1,908	870
Physical difficulty	295	907	509	232
Permanent intellectual	738	2,268	1,272	584
Mobility	1,476	454	2,544	1,160

The data from Table 1 gives an idea of the scope of improvement which could be derived from relatively simple standardization and policy initiatives. For example, making text to speech capabilities compulsory in cell phones could address the needs of approximately 3.4 million individuals who have some or great permanent difficulty to hear in Brazil. As a second example, if research and development work focuses towards low-cost ICT (or AT) and personal computers for people with permanent intellectual disabilities, 584 thousand people could potentially benefit.

Based on the observations above, the Government of Sao Paulo (Brazil) started a project for the establishment of a Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) as an instrument for achieving specific objectives towards promoting the social inclusion of PwD. The aim of CETI-D, that has been conceived by Fondazione Rosselli Americas, is to catalyze the bridging of the knowledge and information gap and foster opportunity which would put technologies (such as AT and ICT) at the service of development for all population groups. The CETI-D is being designed with the vision of creating an information-rich society to enhance the

development and strategic utilization of technologies for national development. The CETI-D is expected to act as a think-tank at the highest level and advise the Brazilian Government on matters pertaining to the development of critical technologies (adaptive, assistive, and information). Furthermore, CETI-D's work portfolio will address a range of issues that benefit marginalized populations (e.g., PwD, people who are illiterate, rural poor, children) across Brazil.

In this chapter, after discussing the problem of the social and economic inclusion of PwD, as well as the opportunities that the inclusion of PwD in the active workforce could bring to the disabled people, to their families and to the communities in which they live, we will present a detailed description of the CETI-D initiative. Based on the example of CETI-D, the aim of the chapter is to show how ICT, when appropriately supported by strategic vision and suitable governmental policies, can turn from potential cause of exclusion into a powerful tool of social and economic inclusion of people with disabilities.

THE SEARCH FOR IMPROVED QUALITY OF LIFE AND ACCESSIBILITY FOR PWD

The Convention on the Rights of Persons with Disabilities and its Optional Protocol was adopted on 13 December 2006 at the United Nations Headquarters in New York. It is the first comprehensive human rights treaty of the 21st century and is the first human rights convention to be open for signature by regional integration organizations. The Convention entered into force on 3 May 2008. The Convention is intended as a human rights instrument with an explicit, social development dimension. It adopts a broad categorization of persons with disabilities and reaffirms that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms. It clarifies and qualifies how all categories of rights apply to persons with disabilities and identifies areas where adaptations have to be made for persons with disabilities to effectively exercise their rights and areas where their rights have been violated, and where protection of rights must be reinforced.

A very innovative component of the CRPD relates to dispositions concerning Information and Communication Technologies (ICT), both from a digital accessibility and assistive technologies (AT) standpoint. Indeed, for the first time, ICT accessibility is defined as an integral part of Accessibility Rights, on par with accessibility to the physical environment and transportation:

To enable PwD to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to PwD access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems... (CRPD, Article 9).

As a result of this definition of accessibility, all the dispositions of the Convention defining the rights of PwD in specific areas of activity and which include the terms "accessible" or "accessibility" include all ICT products and ICT based applications and services, a far reaching implication for industry, governments and civil society. The terms "Accessibility" and "Accessible" are in fact mentioned respectively 9 and 17 times in the text of the Convention, the vast majority of those occurrences in articles covering specific provisions by application areas, which are summarized in the following Table 2 and can serve as a check list for those areas which a Knowledge Economy based approach to the social inclusion of PwD should monitor and address.

Furthering the definition of accessibility including ICTs, "Communication" is defined by the Convention as including all possible means of communications that may eliminate barriers:

"Communication" includes languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communications technologies" (CRPD, Article 2)

Furthermore, when defining the measures States Parties shall take to ensure inclusion, Article 9 on Accessibility specifies:

These measures shall include the identification and elimination of obstacles and barriers to accessibility, and shall apply to (...)

Information, communications and other services, including electronic services and emergency services” (1.b).

Promote other appropriate forms of assistance and support to PwD to ensure their access to information; (2.f)

Promote access for PwD to new information and communications technologies and systems, including the Internet (2.g)

Table 2. Check list for areas of monitoring

Application Areas	CRPD Article	Accessibility Mandates	Reasonable Accommodation	Promoting Assistive Technologies
E-Government	9.2.a	X		
Media and Internet	9.2.b	X		
Education	24	X	X	X
Employment	27	X	X	
Political Rights	21	X		X
Emergency services	9.1.b	X		
Culture & Leisure	30.5.c	X		
Private sector services	9.2.b	X		
Personal Mobility	20			X
Rehabilitation	26			X

Two principles are embedded in the CRPD which have important implications for State Parties and developers of ICT products and services operating under their jurisdiction:

- Incorporating accessibility considerations at an Early Stage of product development:
Promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost (CRPD, Article 9)
- Promoting and applying Universal Design as a universal rule for products and services design. The CRPD includes both a definition and a mandate covering Universal Design:
“Universal design” means the design of products, environments, programs and services to be usable by all people, to the greatest extent possible, without the need for

adaptation or specialized design. “Universal design” shall not exclude assistive devices for particular groups of PwD where this is needed (CRPD, Article 2)

States Parties undertake to ensure and promote the full realization of all human rights and fundamental freedoms for all PwD without discrimination of any kind on the basis of disability. To this end, States Parties undertake (...)

(f) to promote research and development of universally designed goods, services, equipment and facilities, as defined in Article 2 of the present Convention, which should require the minimum possible adaptation and the least cost to meet the specific needs of a person with disabilities, to promote their availability and use, and to promote universal design in the development of standards and guidelines (CRPD, Article 4)

This is the reason why a large consensus on international cooperation and on identifying best practices in matters of accessibility is occurring among innovators, representatives of the largest ICT markets, NGOs focused on social inclusions and educators in quest of the sought-after techniques allowing persons with disabilities fully benefitting of the present Knowledge Society (KS). We believe that this consensus would be better achieved if countries would take the lead in tackling the challenges of persons with disabilities, within the broader framework of the Knowledge Economy (KE).

Selected international best practices

As described in the previous section, the identification of best practices is one of the major joint activities in matters of accessibility in quest of the sought-after techniques and tools allowing persons with disabilities fully benefitting of the present KS.

It has been widely demonstrated that the field of technology is a fertile ground for the economic and social inclusion of people with mobility disabilities or physical limitations. In principle, technology increases the possibilities for more participation of PwD in education, labor markets, and society at large. For instance, jobs in the technology sector do not depend on physical strength, but instead on intellectual knowledge and experience, meaning that someone with a physical disability can perform the tasks at the same level as a non-disabled person.

PwD and their communities can derive enormous benefits from access to, and use of, assistive technologies (ATs) and information communication technologies (ICT). ATs and ICTs can have a twofold impact on PwD. On the one hand, these technologies offer unprecedented potential for supporting innovative means of access and interaction to key aspects of life such as information, social exchanges, economic activity, education, and health. On the other hand, since access to these technologies is as relevant as physical accessibility, inaccessible AT and ICT solutions can worsen the relative disadvantage of PwD.

In the next section we will present some selected international practices concerning the use of ATs and ICTs for fostering the social inclusion and well-being of PwD:

The Centre for Excellence in Universal Design (CEUD), Ireland (<http://www.universaldesign.ie/>)

The CEUD is part of the National Disability Authority (NDA) of Ireland. NDA is the lead state agency on disability issues and universal design, providing independent expert advice to the Government on policy and practice. CEUD was established by the National Disability Authority (NDA) in January 2007 under the Disability Act 2005.

The Centre is dedicated to the principle of universal access, enabling people in Ireland to participate in a society that takes account of human difference and to interact with their environment to the best of their ability. The Centre focuses on three main areas of activity involving: standards development and promotion; education and professional development; and, awareness-raising.

To contribute to the development and promotion of standards in Universal Design, the Centre:

- (1) stimulates and informs research by commissioning, collaborating in and conducting studies;
- (2) participates in and contributes to relevant standardization work, with national, European and international standards bodies;
- (3) provides expert advice and information to relevant stakeholders involved in implementing and promoting standards;
- (4) encourages compliance with national and international standards in Universal Design.

To enhance education and professional development, the Centre is responsible for: ensuring the development of appropriate Universal Design courses, in liaison with relevant academic, certifying and professional bodies; supporting and promoting the introduction and integration of the principles of Universal Design in educational and training courses; and ensuring, whenever possible, the principles and application of Universal Design are included in examinations recognized by professional bodies.

To raise awareness of Universal Design, the Centre operates in a manner to develop and maintain a knowledge base of good practice in Universal Design, to promote public awareness of the difficulties encountered by people in relation to the environment and to promote an understanding of Universal Design.

The CEUD is also the National Contact Centre for the European Design for All e-Accessibility Network (EDeAN: www.edean.org/). EDeAN is a network of 160 organizations in European Union member states. The goal of the network is to support all citizens' access to the Information Society.

The Center for Assistive Technology and Environmental Access (CATEA), USA

(www.catea.gatech.edu)

CATEA is a multidisciplinary research and development center dedicated to promoting the health, activity and participation of people with all levels of ability through the application of assistive and universally designed technologies that enhance the usability, equitability and safety of real world products, environments, and devices.

CATEA's multidisciplinary efforts are manifest in two Rehabilitation Engineering Research Centers (RERCs) on Workplace Accommodations (www.WorkRERC.org) and Wheeled Mobility (www.mobilityRERC.org) funded by the National Institute on Disability and Rehabilitation Research. The 5-year federally-funded projects represent two of the 22 similar Centers nationwide and support a number of faculty and students from a variety of disciplines within the College of Architecture (COA), Georgia Tech and affiliated Universities and Healthcare facilities, including Duke University, Georgia State, University of Pittsburgh, Syracuse University, Shepherd Center, Atlanta VA and Emory University.

CATEA has four laboratories:

- The Rehabilitation Engineering and Applied Research Laboratory focuses on the design and evaluation of wheelchairs and other rehabilitation devices as well as a broad range of interventions that impact device use, activity performance and participation in everyday life.
- The Accessible Workplace Laboratory focuses on enabling equitable access to employment, enhancing employment outcomes, and increasing opportunities for participation in the workplace by people with functional limitations through increased availability of and access to assistive technology and universally designed accommodations.
- The Enabling Environments Laboratory applies an understanding of functional diversity to design, from the design interfaces, to the design of products, to the design of spaces, to enhance the performance and participation of all individuals, to the greatest extent possible.
- The Accessible Education and Information Laboratory, works to promote accessible and usable digital media for all people. It conducts research and training on inclusive technologies and practices for the online world, with an emphasis on accessible online education and training.

CATEA staff are engaged in a wide array of interdisciplinary collaborations across the Georgia Tech campus by supporting academic programs through course offerings in industrial design and architecture

that focus on human-centered design, Universal Design and research methods; serving as advisors on dissertation and thesis projects; and through research assistantships for graduate students who are interested in pursuing areas of research related to CATEA's mission.

The Job Accommodation Network (JAN), USA (<http://AskJAN.org>)

The Job Accommodation Network (JAN) is a service provided by the U.S. Department of Labor's Office of Disability Employment Policy (ODEP). JAN is one of several ODEP technical assistance centers. JAN's mission is to facilitate the employment and retention of workers with disabilities by providing employers, employment providers, people with disabilities, their family members, and other interested parties with information on job accommodations, entrepreneurship, and related subjects. JAN's efforts are in support of the employment, including self-employment and small business ownership, of people with disabilities.

JAN is located on the campus of West Virginia University since its inception in 1983. Initially, JAN consulted primarily on sensory disabilities, those involving hearing, vision, touch, or speech impairments. Until the early 1990s, about 30 percent of JAN's requests addressed these disability areas. As computers, office machines, cell phones, wireless communication, and similar technology became common in workplaces, employees with all types of impairments needed to be able to use the technology. As caller questions became more technical, JAN consultants changed to a team approach, dividing into motor/mobility, sensory, and cognitive/neurological teams.

With the implementation of the Americans with Disabilities Act of 1990 (ADA) in 1992, more individuals began calling JAN and more cases focused on accommodating individuals with motor/mobility disabilities. Prior to 1992, JAN averaged 630 accommodation inquiries per month. In 1992, cases soared to over 1,600 per month and continued to steadily rise throughout the 1990s, ending with an average of almost 3,000 per month. JAN now averages between 32,000 and 38,000 inquiries and nearly 4,000,000 Website customers.

JAN also offers information about entrepreneurship for people with disabilities. JAN consultants handle each inquiry on a case-by-case basis offering self-employment and small business development expertise and referrals regarding business planning, financing strategies, marketing research, disability-specific programs, income supports and benefits planning, e-commerce, independent contracting, home-based business options, and small business initiatives for disabled veterans. JAN customers can expect to receive a resource packet tailored to their specific entrepreneurial goals with consultants available throughout all stages of the process who can provide ongoing supports.

This technical assistance is provided in English and Spanish and is free of charge via telephone, email, chat, and postal mail. All communications are confidential and available to employers, medical, and rehabilitation professionals, people with disabilities as well as anyone else who is interested in workplace accommodations.

JAN supports private employers by providing JAN's customized Webcasts, Second Life training, online application systems and Website accessibility assessments, and other technical assistance materials designed specifically for their industries' workforce.

JAN has either a partnership or collaboration with the: United States Business Leadership Network (USBLN), Assistive Technology Industry Association (ATIA), Computer/ Electronic Accommodations Program, Equal Employment Opportunity Commission (EEOC), USDA TARGET Center, and Regional Disability and Business Technical Assistance Centers (DBTACs), to name a few.

The Mada Center for Assistive Technologies, Qatar

The Qatari Supreme Council of Information and Communication Technology (ICT QATAR - <http://www.ictqatar.qa/en>) together with organizations from the public and private sectors announced plans on April 17, 2009, to establish an independent Center for Assistive Technology in Doha that will be dedicated to helping people with disabilities through information and communications technologies.

The Mada Center for Assistive Technology objective is to serve as a catalyst for research and development of ICT assistive technologies and to create public awareness around best practices and

solutions. In addition to showcasing and facilitating the access to assistive technologies for PwD, the Center will serve as a vehicle for cooperation with industry partners and to coordinate the efforts of existing institutions in Qatar and the region.

Discussions with the leadership of the Mada Center indicate that the Mada Center will likely launch initiatives to serve the needs of disabled persons throughout the Arab Region such as a portal showcasing solutions and open source assistive software in Arabic. Qatar has already funded in the past major initiatives such as the first international conference and program to standardize Arabic Sign Language. The Center is a direct outcome of series of meetings held by the Assistive Technology Working Group (ATWG), that ictQATAR formed in October 2008 in response to the International Telecommunication Union's announcement of 2008 as the year to connect PwD through ICT. ATWG includes many of the leading organizations that work with people with disabilities from the government, not-for-profits and corporate sectors. Local partner organizations include the Shafallah Center, the Al-Noor Institute, and the Qatar Society for People with Disabilities, and the Supreme Council of Family Affairs. The Mada Center for Assistive Technologies is still in its start-up phase.

CONTRIBUTION OF PWD TO THE DEPLOYMENT OF A KNOWLEDGE BASED ECONOMY

The “digital divide” describes the perceived growing gap between those who have access to and the skills to use information and communication technologies (ICT) and those who, for socioeconomic and/or geographical reasons, have limited or no access. The phrase reflects the prevalence of socioeconomic and structural inequalities at the regional, national and local levels, which are characterized by insufficient infrastructure, relatively high access costs, inappropriate or weak policy regimes, inefficiencies in the provision of telecommunication networks and services, lack of local content, and uneven ability to derive economic and social benefits from information-intensive activities. In particular, it is used to raise the concern that the emergence of ICT could exacerbate existing inequalities in the access to information and that, thereby, certain groups could face additional disadvantages because of their geographic location, age, gender, culture, and social, economic and health status, among others (OECD, 2001; Hargittai, 2003).

People with disabilities (PwD) are among those who are at a major risk of social exclusion and of inequality in accessing information and transforming it in knowledge, due to the wide range of difficulties they experience in using ICT (Dobrinsky & Hargittai, 2006). Actually, for people with disabilities, who already are at a risk of social exclusion due to their status, far from being a means to improve their living conditions the spreading of ICT can represent a further cause of exclusion, especially for those living in the less developed and poor countries. From this point of view, the problem of the social and economic inclusion of PwD represents a further aspect of the digital divide phenomenon.

The Knowledge Economy (KE) paradigm embodies a novel approach to digital divide that is being successfully adopted by many developing countries (especially within the Latin America and Caribbean region) as the basis for their development strategies (Dahlman, 2007; Piaggese & Chea, 2011). In this section we will show how in a KE based approach also the problem of the social and economic inclusion of PwD can be coped with in an interesting and novel way.

Today's global economy is in transition towards a “Knowledge Economy” (KE), that is, an interconnected, globalized economy where knowledge resources such as know-how, expertise and intellectual property are more critical than other economic resources such as land, natural resources, or even manpower (Avgerou et al., 2005). In today's Knowledge Society, knowledge becomes a source of competitiveness, where value lies in new ideas, services and relationships, using technology as an instrument, not as an end in itself. Formally, the KE could be defined as the added, non-monetary value that society accrues from increased access to information, data and knowledge, as a spinoff of the new global communication and data processing technologies (Vitro, 2005).

Capturing and representing the value of such knowledge and introducing it as a factor in decision-making, is what the knowledge economy is about. By the application of the objectives, principles, methods and

instruments of the KE, such added value is realized through a concerted effort to capture, analyze, disseminate and evaluate knowledge (cultural, indigenous, scientific, institutional, local, adapted etc), converting the intangible nature of knowledge into a resource with market and societal value. Asia's experience has shown that successful incursion into the KE will be based on simultaneous and combined investment in five pillars (Piaggese 2011, June):

- (i) strong intellectual property rights systems;
- (ii) education;
- (iii) innovation;
- (iv) information and communication technologies (ICT);
- (v) (perhaps more importantly for developing countries) social inclusion (this last element is what will make the difference between "growth" and "development").

The KE concept has application in the realm of international development at two levels: MACRO and MICRO (Piaggese, 2011, June). At the MACRO - country level - the KE is a planning tool aimed at giving the country comparative advantage over others by investing in sectors where growth can be based on the capture and dissemination of knowledge: unique indigenous knowledge that can become a valuable asset; new knowledge that can be developed internally; or knowledge developed elsewhere that can be adapted to the unique conditions of the country. At the MICRO - individual organization or enterprise level - where this concept bears interest for the CETI-D, the KE is a strategic growth choice used to achieve greater effectiveness, efficiency or reach where growth is impeded by a "knowledge challenge": existing knowledge that is yet untapped; gaps in required knowledge; or the need to adapt knowledge developed elsewhere to the specifics of the organization or enterprise.

In order to maximize the potential of comparative advantages as well as to make the most of knowledge capital, simultaneous investment is needed in five interrelated fields:

- Innovation;
- Education;
- Social inclusion;
- Information and communication technologies (ICT);
- Enabling policies

It is the simultaneity in the intervention of the five pillars that differentiates the KE from other more conventional development strategies, such as for example, investment in science and technology alone. By itself, such single-sector investment may generate valid and important products, but its potential can be curtailed due to absence of a concerted effort to make those products into long-lasting with little significant social impact; here is where the KE makes its different contribution: by applying a package of simultaneous investments, connected to each other, all pursuing a single common strategic objective, it results in a socially inclusive development. Considering social inclusion as one of its pillars and pursuing an integrated approach to development, the KE paradigm embodies a novel approach to digital divide. Approximately 1 billion people live with some type of disability worldwide, out of which nearly 200 million experience considerable difficulties in functioning (WHO, 2011). With current trends in population, medical advances and an increasingly graying population, and because of the global increase in chronic health conditions associated with disability, such as diabetes, cardiovascular diseases, and mental illness, this number will only grow. Persons with disabilities tend to be acutely vulnerable to exclusion. PwD when are poor are disproportionately poor and poor people when are disabled are disproportionately disabled (Elwan, 1999; Yeo, 2005), also due to the financial cost of disability for PwD and their families (Berthoud, 1991; Stapleton, Protik & Stone, 2008) Furthermore, there are an estimated 150 million children in the world with disabilities (UNESCO, 2011); about four-fifths of them in developing countries, as well as more millions live with disabled parents or relatives. Over 80% of PwD live in isolated rural areas in developing countries. Some 62 million children of primary school age have a disability; 186 million children with disabilities have not completed primary

school, and fewer than 2% of children with disabilities in developing countries are in school (UNESCO, 2009).

According to the World Report on Disability, people with disabilities have poorer health outcomes, lower education achievements, less economic participation and higher rates of poverty than people without disabilities, facing barriers in accessing health, education, employment, and transport services, as well as information. These difficulties are exacerbated in less advantaged communities (WHO, 2011).

No society can ignore such a massive number of people and leave them to their own destiny. In addition to these circumstances, PwD also feel that they have very little to say in plans and programs that are supposedly provided for their welfare, for the improvement of their conditions.

People with disabilities represent approximately one sixth of the working age population globally; therefore considering them simply as a minority that just needs to be assisted not only would be unfair, but it is definitely anti-economic. People with disabilities represent approximately one sixth of the working age population globally; therefore considering them simply as a minority that just needs to be assisted not only would be unfair, but it is definitely anti-economic. On the contrary, making this substantial part of the potential workforce productive by including it within the active population, not only can contribute to the economic development but also makes PwD an asset rather than an impediment for an inclusive society.

The data reported in (Bichard & Thomas, 2008) clearly show what this means. Based on a study on disabled entrepreneurs in the England's Northwest and the wealth they can bring to the region, Bichard and Thomas show how a shift from subsidy into self-employment might benefit both the region and the whole country. They report that in the Northwest of England there are 140,000 disabled people who want to work and claim that 14,000 disabled people would consider setting up a business (this is a conservative estimate based on the 14.4 per cent of disabled people who are self employed nationally). Based on this estimate, Bichard and Thomas calculate that 14,000 new disabled entrepreneurs would add £ 280 million (more than \$ 452 million and more that € 347 million) to the regional economy. Generalizing to the national level, they conclude that:

“Taking the net gain of Gross Value Added and benefit savings together, assistance to the prospective disabled entrepreneur community would be worth a weighty £ 339 million, or over one third of a billion pounds to the Northwest. Nationally, the corresponding numbers would produce 88,000 new entrepreneurs with a net economic benefit to the country of over £2.1 billion” (p. 6)

An interesting calculation of the economic impact of the inclusion of PwD within the active workforce is contained also in (Wilhelm & Robinson, 2010), based on data concerning the evaluation of the Vocational Rehabilitation program implemented by the Utah State Office of Rehabilitation with the aim of assisting eligible individual with disabilities to prepare for and obtain employment. Besides reporting sensible economic benefits to the individual, in terms of a large increase in earnings for disabled people who are already working and an increase in the likelihood of employment for those who were not working, Wilhelm and Robinson also calculate the benefits for the State of Utah. Considering the fiscal year 2005, such benefits amount to a savings of over \$ 34 million for the reduction of various benefits paid to PwD and to more than \$ 32 million in increased state tax revenue, due to the taxes paid by the PwD employed thanks to the Vocational Rehabilitation program. This gives the interesting result of a return of \$ 5.64 to the state economy for every \$ 1 of state funds spent on the program.

Both the studies concerning Northwest England and Utah acknowledge that many barriers still remain to the employment of PwD, which would limit the possibility of achieving positive results if not removed (or at least reduced). A study conducted by a research group of the University of Chile on the socio-economic impact of disability in Chile and Uruguay (Contreras et al., 2006) gives support to this conclusion.

The study compares the effect of different policies oriented to individuals with disabilities and their effect on the reduction of poverty and inequality. The result of the simulation both for Chile and Uruguay shows

that in order to reduce poverty among disabled people policies based on the payment of subsidy are more effective than policies aimed at the inclusion of people with disability in the labor market.

In the case of Chile, allocating a subsidy to all individuals with a disability who are not currently receiving the subsidy reduces the poverty rate of individuals with disability from 23.4% to 16.9% (the country level poverty rate is 15.4%). Also, the prevalence of disability among poor people reduces from 10.7% to 8.2% (the country average is 7.0%). On the contrary, the inclusion of people with disability in the labor market has minor effects on poverty; actually, poverty rate is reduced from 23.4% to 21.7%, and the prevalence of disability among poor is reduced from 10.7% to 10.1% only.

In the case of Uruguay, creating a lump sum subsidy of 90% of Poverty Line reduces poverty from 39% to 22.7% for individuals with a disability and the prevalence of disability among poor is reduced from 15.2% to 9.9% (the country average is 9.7%). The inclusion of people with disability in the labor market only reduces poverty rate from 39% to 36.7%, and the prevalence of disability among poor is reduced to 14.4% only.

Both in the case of Chile and in the case of Uruguay the study explains the limited effectiveness on poverty reduction of the policies for the inclusion of people with disability in the labor market with the fact that workers with disability have much lower human capital than the average worker and also work a reduced number of hours, so that the salary they would receive is not particularly important.

The Contreras et al., (2006) conclusions are confirmed by Hernandez and McDonald (2007) that, based on a study conducted in the Chicago area, reports that on an interval of employment of 6 month workers with a disability work 1.24 fewer days than workers without disabilities due to scheduled absence, and 1.13 fewer days due to unscheduled absence. However more interesting are the data concerning job performance and the positions occupied by workers with disability. Whereas employees with and without disabilities obtain nearly identical average performance ratings, there is a lack of promotion opportunities for workers with disabilities that, especially when known to employers to have a disability, are more likely to be employed in entry level and semi-skilled positions. From this point of view, the fundamental problem for the inclusion of PwD within the economically active population concerns human capital, not only with respect to the level of the human capital they have but also with respect to how their human capital is acknowledged and exploited in the workplace.

Any vision of empowering PwD must include the provision of access to information and knowledge, because that is the best way to empower people – to enable them to become productive citizens and to lead a life of dignity of their own. The acceleration and pervasive usage of ICT applications in all aspects of contemporary society make ensuring their accessibility for people living with disabilities indispensable. On the other hand, the acceleration of innovation tends to create a growing accessibility gap in all ICT areas. While new ICT based assistive technologies bring unprecedented opportunities for persons living with disabilities, innovators lack proper funding and industry remains very fragmented. A more comprehensive approach is an imperative when we look at the implications of the UN Convention on the Rights of persons with Disabilities. The new accessibility imperative is thus better suited to be accomplished within a framework that seamlessly takes into consideration, investments in innovation, ICTs, and the full participation of people with disabilities into our modern society, their peculiar knowledge stemming from a suite of unique skills as a product of their heightened senses.

As all major and wide-ranging technological advances, the ICT revolution is posing daunting challenges, but at the same time is creating enormous opportunities. Actually, if on the one hand the ICT revolution can exacerbate inequalities and social exclusion, on the other hand ICT can also represent a powerful tool that can be used to foster the social inclusion in general and particularly of people with disabilities within the active labor force and, therefore, in the present Knowledge Society (KS). However, this can be done only by means of the implementation of inclusion policies based on ICT, including the development of technological tools specifically devised to support people with different kinds of disabilities, coupled with sound policies on innovation, education and government reforms. This is exactly what the Knowledge Economy integrated approach amounts to.

THE CENTER OF EXCELLENCE IN TECHNOLOGY AND INNOVATION FOR THE SOCIAL INCLUSION OF PERSONS WITH DISABILITIES (CETI-D) IN SAO PAULO (BRAZIL)

Ensuring participation in the present Knowledge Society and ensuing Knowledge Economy puts the onus on all stakeholders to ensure that no-one gets left behind whether for reasons of disability, poverty, gender, age, locality or personal ability. Strong collaboration between public, private and third sector actors can ensure that all play a part in bridging the digital divide that exists today, particularly for people with disabilities.

One of the key benefits of a partnership of expertise - among the people with disabilities, governments and the private sector - is the dismantling or breakdown of silos between social policy makers, businesses and technology professionals, and end users so that the capability of AT and ICT to tackle disadvantages can be fully exploited. This partnership needs to include all users groups, end-users, communities, local service providers (educational, social and health services, emergency services etc) to really achieve livable communities developed with the participation of all stakeholders.

The capability of technology alone to meet the needs and demands of our complex societies is very limited. It also needs the engagement of a wide array of interested parties, especially those who are the intended users and beneficiaries, in deciding why, how, what, when and where it should be put to use. That is key to successful delivery of desirable outcomes such as accessible, affordable, and available technologies. This is the core principle of the Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) in Sao Paulo (Brazil) that will be described in the next sections.

The policies for Digital inclusion in Brazil

Brazil has committed itself to a digital inclusion effort for all segments of its population. Since 2005, the government of Brazil has invested more than \$509.2 million in digital inclusion projects. This activity has been developed and undertaken by the ministries of Communications, Planning and Science and Technology. In 2008, the Ministry of Communications invested \$134 million in projects that include the deployment of Community Telecenters in cities around the country, as well as operating system access to broadband Internet (<http://www.mc.gov.br/programas-e-projetos/>)

The Community Telecenters program is the federal government's effort to decrease the number of Brazilians who are excluded from the world of computing. The program involves the assembly and delivery of a computer center with Internet access, which serves a group of at least 10 people. Each telecentre kit consists of 11 computers - 10 terminals and a server - a laser printer, data projector and a router for Internet access; and, some furniture, including cabinets, chairs and tables.

From 2008 until July 2009, 6,076 telecentres were delivered to 5,469 Brazilian cities. As a result, by mid-2009, 98.29% of Brazilian municipalities were covered. From October 2009, when it began the second phase of the program, the Ministry of Communications launched new bidding rules for the purchase of an additional 15,000 kits of computer equipment, audio-visual equipment and for the installation of telecenters in all municipalities. Ultimately, the government achieved the goal of deploying 21,000 community telecentres by the end of 2010 by making 231,000 computers with free internet access available to the population at large.

Beyond the effort to expand the Community Telecentres program, the government wants to take internet services and cellular telephony to rural regions of Brazil. In 2009, the Ministry of Communications set up the National Rural Telecommunications entity to enable rural population access to these services.

Another area involving the promotion of public policies for digital inclusion has led the ministries of Communications and Education to develop a strategy to ensure broadband in public schools. In 2008, the government struck a deal with telecom operators to replace some of the obligations under the concession agreements with operators of fixed telephony services. Originally, contracts signed in 2005 forced companies to install telephone service stations (PSTs) in every Brazilian city. The PSTs involved the

operation of a terminal of fixed telephone, a fax line and dial-up Internet. As a result of the deal struck in 2009, companies were required to bring broadband in urban public schools.

As a result, by June 2009, approximately 30,000 schools across the country were connected, representing more than half the total of schools in central cities. By the end of 2009, the Ministry's expectation was that 45,381 schools would be connected, representing 80% of all urban public schools. According to the government, the Broadband in Schools program will last until 2025. All urban public schools were expected to be connected by the year 2010, but, by March 2012, 8,923 (12.8%) schools remain with no access to broadband internet.(ANATEL 2012)

The next step is to bring broadband to rural schools. This effort is being realized through the Electronic Government Service to Attend Citizens, GESAC (<http://www.gesac.gov.br/>), which provides internet connection via satellite for digital inclusion, education and e-government initiatives throughout the Brazilian territory. That's because, on 24 July 2009, the Ministry of Communications published the decree establishing the National Rural Telecommunications program. The goal is to enable the rural population access to telephony and broadband data (internet) services. The ordinance provides for connection to high-speed Internet, free of charge for all rural public schools in the country. More than 80,000 rural schools are to be connected.

Brazil's Digital Inclusion initiative aims at promoting the rights of marginalized populations, including the rights of PwD for which Brazil ratified the U.N. Convention on the Rights of PwD. The project for a Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) to be established in Sao Paulo has been conceived to be an instrument for achieving specific objectives of the Government of Sao Paulo towards promoting the social inclusion of PwD. As such, the CETI-D can play a role also in Brazil's digital inclusion (for all) initiative in a number of ways:

- it can undertake work in developing low-cost and accessible ATs and ICTs that would be installed in connected telecentres
- it can work with connected schools whose teaching staff needs technology knowledge transfer training for the adoption and/or adaptation of instructional ATs and ICTS for use with individual students with disabilities
- it can work with business and industry, as well as the education sector, on the intersection of issues of workforce development and training on the use of technologic innovations in the workplace and in schools.

CETI-D concept

The Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) was conceived as a means to push the Government of Sao Paulo's strategic agenda in defense of the rights of PwD forward into the realm of knowledge-based micro-economies, globalized services, state-of-the-art technology and other means that would allow the State of Sao Paulo to leap from the traditional "assistance" model to a "social inclusion" model where PwD are active and valuable members of society.

Three basic tenants sustain the idea of CETI-D:

- PwD have special needs –transportation, communications, medical attention, public services, among others, of whose provision the whole society is responsible, not only the State;
- PwD have special capabilities and specialized knowledge revealed by scientific research and empirical evidence associated to the need to compensate for lost senses, limited mobility or other impediment, which could be turned into valuable skills;
- through social inclusion, PwD could make significant contributions to today's Knowledge Society and related Knowledge Economy, as their special capabilities, currently underutilized in absence of means to make practical use of them, could become very useful

CETI-D's institutional objective is to support the work of the São Paulo's State Secretariat for the Rights of the Person with Disability (SEPDcD) by identifying technological and organizational solutions to

maximize the social inclusion of PwD, and developing such solutions to a level where they can be applied massively in a cost effective way.

CETI-D's core strategy is the application of the concept and instruments of the Knowledge Economy, that means to:

- pursue a given concrete objective through simultaneous investment and work in the five areas that constitute the instruments of the KE, not in one of them alone, but in all of them at the same time with highly focused purposes and doable targets.
- leverage major KE related programs deployed by the federal government such as computers and broadband in schools and the promotion of telecenters in order to promote CETI-D universal cloud based AT solutions
- develop training programs for AT educators in collaboration with universities of interdisciplinary AT support courses (rehabilitation and/or specific education)
- emulate the JAN network in Brazil in cooperation with universities and employer's associations
- leverage government efforts in favor of broadband adoption and engage study of telework opportunities for disabled persons in cooperation with employers associations
- invest in the creation of dedicated web-based services for PwD to be managed by organizations of PwD linked to the State of Sao Paulo portal for disabled persons

CETI-D's simultaneous investments in research, technology, education, social inclusion and enabling policies – the main instruments of the Knowledge Economy—have direct application to the quest for greater and more productive inclusion of PwD in society. Implications for CETI-D's work are at the national-level (macro) and at the individual-level (micro).

At the macro-level, in order to bring PwD into inclusive knowledge societies, there are certain conditions that must be met, namely, the enabling of national policies and strategies. Capacity must be built so that people can undertake the activities that foster inclusion. This includes infrastructure development. If, for example, there is no ICT connectivity there is no access to content. In addition, even if there is ICT connectivity, there is also a need to develop capacity for generating local content in the language that people can understand. ICTs must be developed from the very beginning to be inclusive; otherwise, the cost of modifying the ICTs is going to be enormously prohibitive. Investments into research and development around ICT standards of services must be made available, otherwise it is not possible to guarantee and enable access to all.

At the micro-level, because disabilities involve functional limitations, it is often difficult or impossible for PwD to interact with their communities and societies without AT and ICT. This technology can be highly technical and disability specific. Often, however, the provision of access for PwD to a mainstream technological innovation is more cost-effective than creating a specialized technology. For example, e-mail has revolutionized the communicative abilities of people who are deaf or hard-of-hearing at a fraction of the cost of the highly specialized communication equipment previously developed for their use; and personal computers, the Internet and e-mail have increased the social and economic access of people with impaired verbal capabilities in a similarly cost-effective way. Whether they are specially designed to meet the needs of PwD (e.g. Braille writers, prosthetic devices, wheelchairs and hearing aids) or innovative adaptations of mainstream technological innovations (e.g. e-mail, the Internet and personal computers), assistive technologies are vital to the process of providing social and environmental access to a significant cross-section of PwD.

Based on the principles above, CETI-D's operational objectives are to:

- attract high level Brazilian and international experts working in the various fields of interest for PwD, and offer them an environment where innovation and creativity are encouraged, in close interaction with the international community
- conduct research to unveil and demonstrate skills, particular conditions, and special cognitive abilities of PwD, which could constitute attractive capabilities in the job market

- develop technological innovations, and their industrial applications, to generate products directed at facilitating the use of the special abilities of PwD, improving their quality of life and facilitating their inclusion in society
- identify and develop job market niches able to utilize the special capabilities of PwD in cooperation with private sector enterprises looking to pursue this new source of specialized labor force for the benefit of their own private companies
- identify possible adaptations that could be made in the main areas of interaction between PwD and the rest of society, in order to improve their inclusion into society and their quality of life, starting from the architecture of housing and public services, to social communications and human relations
- identify national and international financing mechanisms to support research; industrial innovation; education, training and job-generation; social structure adaptations and other proposals advanced by the CETI-D with help from its support networks to enhance the development and strategic utilization of technologies for national development.

The CETI-D is expected to act as a think-tank at the highest level and advise the Sao Paulo Government first and other Latin American countries later, on matters pertaining to the development of critical technologies (adaptive, assistive, and information). It is a “smart partnership” between the private, public and community sectors.

Furthermore, CETI-D’s work portfolio could address a range of issues that benefit marginalized populations (e.g., PwD, people who are illiterate, rural poor, children) across Brazil. Important issues to consider include potential differences in language, literacy, relevance of content, connection speed, access to ATs and ICTs, and cultural patterns of education and leisure and work. Potentially useful directions for CETI-D’s work include not just whether prevailing assumptions about technology use correspond with reality, but how these assumptions are formed and perpetuated.

At the international level, Brazil has all the ingredients to become a global leader in accessible and assistive technologies: a strong IT industry, a proactive government, a leading Internet usage, the commitment to promoting the rights of disabled persons and a large domestic market.

By exploiting the potential of its multi-stakeholder approach, CETI-D offers the opportunity for academics, industry and government leaders to jointly develop a roadmap for developing accessibility services and R&D programs with global potential which would also strengthen its own domestic objectives, especially with respect to:

- Mobile phone applications
- Cloud based AT services
- High added value IT based condition specific ATs

In all these areas, Brazil’s success could lead to significant AT volumes and economies of scale thus contributing to lowering costs for international markets as well.

CETI-D institutional structure

The Statutes or Bylaws of CETI-D will establish, among others, the overall mandate and objectives of the Institution as well as the structure of its net worth, sources of income, and its governance, organizational and personnel structure. Figure 1 below shows the principal structures for CETI-D at its start-up phase.



CETI-D Institutional Structure



Figure 1: CETI-D Institutional Structure

In particular, we would like to draw the attention on three of the four departments:

R&D in Specific Abilities, Innovation, Industrial Applications Department.

The R&D in Specific Abilities, Innovation, Industrial Applications Department would be responsible for contributing to the fulfillment of three of CETI-D's objectives:

- attract high level Brazilian and international experts working in the various fields of interest for PwD, and offer them an environment where innovation and creativity are encouraged, in close interaction with the international community;
- conduct research to unveil and demonstrate skills, particular conditions, and specific cognitive abilities of PwD, which could constitute attractive capabilities in the job market; and
- develop technological innovations, and their industrial applications, to generate products directed at facilitating the activities of daily living of PwD, improving their quality of life and facilitating their inclusion in society.

Job Creation, Education, Training and Business Services Department.

The Jobs Creation, Education, Training and Business Services Department would be responsible for contributing to the fulfillment of CETI-D's objective to identify and develop job market niches able to utilize the specific capabilities of PwD in cooperation with private sector enterprises looking to pursue this new source of specialized labor force for the benefit of their own private companies.

Accessibility Infrastructure, Housing and Public Services Department.

The Accessibility Infrastructure, Housing and Public Services Department would be responsible for contributing to the fulfillment of CETI-D's objective to identify possible adaptations that could be made in the main areas of interaction between PwD and the rest of society, in order to improve their social inclusion and quality of life, starting from the architecture of housing and public services, to social communications and human relations.

In addition, another innovative aspect of the CETID's modus operandi is the creation of associated structures: the CETI-D Support Networks. The ambitious task the SEDPcD has set out to accomplish through CETI-D in fact cannot be achieved without the support of the community, in particular the support of those in the community in a position to make a change in the conditions and opportunities open to Persons with Disabilities (PwD), physical, sensorial and/or intellectual. Thus, the SEDPcD has established a set of "networks" that link CETI-D with different sectors and actors in the entrepreneurial, industrial, academic and social-work sectors, who can be instrumental in applying the principles and

programs sustained by the Center. In this sense, CETI-D will be a “triple helix” vision in action (Viale & Ghiglione, 2005).

As far as project execution is concerned, CETI-D projects would include multi-year engagements and short-term activities. Project will stem from: mandates of the Board of Directors; initiatives of CETI-D Departments; or recommendations from the Networks. In each case, CETI-D staff, lead by its Executive Director, will prepare project proposals in the context of CETI-D’s annual Business Plans.

While CETI-D is expected to be very active in the identification and development of project proposals, it is not expected to acquire the internal ability to be in charge of all implementation activities.

In addition, a number of options are open to CETI-D as to entering as a member in international organizations. Once CETI-D has been established operationally, consideration to options in this respect can be given by its Board of Directors. At the start-up phase, at least joining as a member the United Nations Global Alliance for ICT and Development (GAID) and contribute actively to its world-wide Matrix Program are considered useful; this collaboration would be a way to include targets concerning achievements in social inclusion and quality of life standards for PwD in the context of Millenium Development Goals (MDG).

Other international organizations could become attractive as the work of CETI-D develops; for example:

- Workability International (WI), the largest organization representing providers of work and employment to people with disabilities; establishing a working relation with WI could bring best practices information to CETI-D and open ways of cooperation among private sector providers;
- Asia-Pacific Development Center on Disability (<http://www.apcdfoundation.org/>), which could add an interesting perspective on non-Western concepts of disability and corresponding treatments;
- Disabled People’s International (<http://v1.dpi.org/lang-en/>) could also be a contact of interest, as it holds a number of regional offices, one in Latin America , which could be helpful for the use of their extensive data bases;
- Inclusion International (<http://www.inclusion-international.org/en/>) could also be a link to study for its strong lobbying expertise.

As part of the policies for fostering the inclusion of PwD, the primary objective of the establishment of CETI-D’s is to address the specific needs of PwD. However, the concept of CETI-D embodies principles whose implementation can also help achieve general outcomes, both at the national and the international level. This is due to the assumption of: a KE based approach to the inclusion of PwD, which requires simultaneous investments in research, technology, education, social inclusion and enabling policies; and a multi-stakeholder approach, which entails the involvement of many different actors that coordinate their activities, first of all, government bodies, industry and universities and academic research centers, following a typical Triple Helix approach. At the national level, CETI-D will catalyze the bridging of the knowledge and information gap and foster opportunities which would put technologies - such as ATs and ICTs - at the service of development for all population groups. CETI-D in fact, has been designed and conceived with the vision of creating an information-rich and inclusive knowledge society, presenting itself as a very innovative e-government example

CONCLUSIONS

In this chapter we described how PwD could successfully contribute to the knowledge based economy and how a knowledge economy based approach can foster the social and economic inclusion of PwD. Such an approach has been adopted by the State of Sao Paulo through the CETI-D project. Justification for the creation of CETI-D can be traced to existing commitments by Brazil to promote the rights of marginalized populations, such as the Digital Inclusion initiative cited earlier in this chapter. Similarly, Brazil joined the international community to promote the rights of PwD by way of its ratification of the Convention on the Rights of PwD that, among other things, depicts “accessibility” as a fundamental right of PwD. That also includes ICT accessibility. Innovation in technology is regarded as a cardinal priority

for society and government and disability has the potential to figure very strongly in this focus on innovation.

The role of PwD as innovators can and should be active. PwD should be included in the design process because they are good at it. There are two reasons given for this expertise of PwD in design. First, PwD are often outstanding problem solvers because life is often a series of challenges to be overcome for them. Second, innovative ideas are more likely to come from people who have a new or different angle on old problems. Greater participation of PwD in (all aspects of) technology innovation in the short term may just be the necessary trigger for creating a different, and better, system of innovation for everyone in the future. Given its commitment to inclusion, CETI-D's approach involves a rethinking of ideas about productivity and human ability in the light of new notions of PwD as active users and designers of technologic innovations.

Through social inclusion, PwD can make significant contributions to today's Knowledge Society and Knowledge Economy, as their specific capabilities - currently underutilized in the absence of means to make practical use of them - could become very useful. CETI-D's design for research and theorization can help clarify the contribution of disability to innovation; in some instances, there could be work that would be undertaken and directed by PwD themselves as part of a career path. The economic benefits of such an approach could be considerable, not to mention the implications for innovation and productivity. Increasing existing systems of participatory design, could introduce new user-driven approaches into strategically important places in the design processes of ICTs for all people (and possibly in the national innovation system).

In another vein, CETI-D's research and development work in the area of producing accessible technology products has the potential to place accessible and affordable ICTs (and ATs) in the hands of millions of Brazilians and other emerging countries who currently may not be involved in the burgeoning knowledge economy.

As part of the policies for fostering the inclusion of PwD, the primary objective of the establishment of CETI-D's is to address the specific needs of PwD. However, the concept of CETI-D embodies principles whose implementation can also help achieve general outcomes, both at the national and the international level. This is due to the assumption of:

- a KE based approach to the inclusion of PwD, which requires simultaneous investments in research, technology, education, social inclusion and enabling policies;
- a multi-stakeholder approach, which entails the involvement of many different actors that coordinate their activities, first of all, government bodies, industry and universities and academic research centers, following a typical Triple Helix approach.

The applicability of the CETI-D's approach is not limited to the State of Sao Paulo; the CETI-D model can be replicated elsewhere, the only conditions for its replication being the embracing of the fundamental principles of Knowledge Economy and the commitment toward an inclusive Knowledge Society.

However, contributing to the creation of an inclusive Knowledge Society through the deployment of affordable and universally accessible ICT requires an environment that facilitates its dissemination and use in various institutional, business and social settings. In particular, the promotion and creation of the necessary conditions are needed to facilitate investment in technological infrastructure and connectivity, promote competition, facilitate access, foster digital education and training, promote the development of local content, and delineate the participation of various stakeholders.

An effective environment conducive to the creation of an inclusive Knowledge Society requires a number of concrete actions under a multi-sector approach:

- strengthening of the institutional capacity with the participation of the public, private and civil society sectors, in order to promote and foster the dissemination and use of universally accessible ICT through programs and initiatives that build a participatory information and knowledge society.

- raising awareness and creating the conditions for the design and implementation of pilot initiatives and the replication of best practices in priority areas including universally accessible ICT for social development, for governance, and for economic growth, among others.
- undertaking the actions necessary to promote a digital inclusion for all.
- creating the organizational conditions for the identification of concrete and comprehensive national ICT investment plans which effectively delineate the participation of the various sectors and stakeholders.
- implementing and/or strengthening national and regional regulatory frameworks to, among others, promote competition and loosen restrictions on the telecommunications market, allow for the expansion of media convergence, and promote and facilitate research and technological innovation.

All the above actions require not only a concrete delineation of the responsibilities that the public sector, private sector and civil society should assume, but also the promotion and establishment of partnerships based on their mandates, responsibilities, purpose and competitive advantages. Indeed, the effective deployment of affordable and universally accessible ICT leading to the consolidation of an inclusive Knowledge Society requires an action-oriented multi-stakeholders approach.

Experience shows that these partnerships allow for addressing multiple issues that cannot be resolved without the concerted efforts of diverse constituents, while also allowing for synergies, coordination and sharing of priority investments, and ultimately leading to a more efficient and sustainable process of economic and social development and inclusion through the deployment of appropriate and innovative technologies.

The Center of Excellence for Technology and Innovation in Favor of Persons with Disabilities (CETI-D) has been designed and conceived with the vision of creating an information-rich and inclusive Knowledge Society, presenting itself as a very innovative e-government example. The CETI-D approach to the inclusion of PwD can be considered as a step toward an inclusive Knowledge Society, starting from people for which the risk of exclusion is higher, that is people with disabilities. As such, the concept of CETI-D, as well as the process that led to its design, incorporate all the principles above.

CETI-D implemented those principles within the context of the Sao Paulo State; however, they are not specific to Sao Paulo and the CETI-D example can be followed by every government that looks at people with disabilities not as people that need assistance, but as active and valuable members of an inclusive Knowledge Society.

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