THE KNOWLEDGE ECONOMY AND PEOPLE WITH DISABILITIES

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Introduction

The purpose of this presentation and resulting paper is to provide an overview of the opportunities and challenges presented by the knowledge economy for the employment and economic well-being of people with disabilities. It is well established that there is a gap, a "digital divide," within and between societies in the degree to which different groups have access to and use information and communications technologies (Cullen, 2003; Dobransky & Hargittai, 2006). This paper presents information on these issues, for people with disabilities, by affording an overview of the following points: the disparities in employment and education for people with disabilities; barriers to technology access in education; barriers to technology access in employment; and the implications for governmental initiatives and policy makers, educators, employer policies and practices, economic development initiatives, and disability advocacy organizations.

People with disabilities represent approximately one sixth of the working age population globally, yet people continue to be significantly un- and under-employed compared to their nondisabled peers. This means that, to date, people with disabilities globally realise significantly less opportunity for the decent work that provides the resultant income needed to live a healthful and economically productive life. In addition, it means that many countries across the world are missing the opportunity to tap this largely untapped source of labour to strengthen their own economies as well as the well-being of their individual citizens who are persons with disabilities (Bruyere & Ruiz-Quintanilla, 2000).

The rapid growth of information and communication technologies, called the Information Technology (IT) Revolution, and the new industries rapidly being created by these changes, may offer new opportunities for employment for people with disabilities. New jobs are being created continually by these growing industries that may perhaps offer a potential to benefit existing disadvantaged groups, such as those developing countries, people with disabilities, and women. Opportunities to access training and work at a distance may mean access to employment not previously available to many.

There may, however, also be attendant pitfalls to these workplace and labour force changes. Industries are moving quickly to try to take advantage of this revolution to increase their own business advantage, often rapidly changing job requirements and skill sets needed. This often means that those without the skill sets, or means to easily and quickly acquire them, are increasingly marginalised from labour force participation. A new set of accommodations must be addressed in this information age (Light, 2001).

It is an opportune time for this discussion as there is a growing recognition globally of the need to broaden the available labor pool to address the shrinking available talent due to the aging and subsequent changing demographics of the workforce. In addition, there is increasing awareness of the importance of diversity and creating an inclusive workplace

environment. These factors are contributing to an increasingly receptive business environment where addressing disability issues are concerned and an increasing openness to more flexible workplaces in general, specifically the techniques and philosophies of workplace accommodation for people with disabilities. Included among these considerations must be addressing the information technology accommodation needs of people with disabilities and the aging workforce.

Because the workforce is shrinking in many parts of the world simultaneously, older workers and those with disabilities will be valuable members of the job pool of the future. The aging workforce is likely to result in increasing numbers of workers with disabilities, who may have difficulty staying employed. The U.S. Census Bureau projects that the 45-54 and 55-64 year-old population in the United States will grow by nearly 44.2 million (17%) and 35 million (39%) in the next ten years (U.S. Census Bureau, 2004). By the year 2010, this group will account for nearly half (44%) of the working age population (20-64), and the number of people with disabilities between the ages of 50 and 65 will almost double (Weathers, 2006). Disability management and accommodation policies and practices readily lend themselves to addressing the challenges that employers will face with an aging workforce, and the increasing prevalence of disability which these demographics bring. Proactive education about ways to maximize the productivity of an aging workforce, effective case management, and workplace accommodation can significantly contribute to maximizing aging worker retention.

In addition, there is now greater international contextual support for the interests of persons with disabilities by the recent passing of the U.N. Convention on the Rights of Persons with Disabilities.[2] The purpose of the convention is to promote, protect and ensure the full and equal enjoyment of all human rights by persons with disabilities. It covers a number of key areas such as accessibility, personal mobility, health, education, employment, habilitation and rehabilitation, participation in political life, and equality and non-discrimination. The convention marks a shift in thinking about disability from a social welfare concern, to a human rights issue, which acknowledges that societal barriers and prejudices are themselves disabling.

Employment and Income Disparities for People with Disabilities

It is timely and imperative that the issues surrounding employment of people with disabilities be addressed because, despite significant efforts globally to improve upon the employment and social integration status of people with disabilities, significant disparities between the status of people with disabilities and their non-disabled peers remains. According to statistics from the American Community Survey (ACS), in 2005 the employment rate of people aged 16-64 with sensory, physical, mental, and/or self-care disabilities was 37.5%, compared to 74.5% for people the same age without disabilities (Houtenville, Erickson, & Lee, 2007). In addition, the percentage of working age men and women with a disability in the United States with incomes below the poverty line was 25% in 2005 (Rehabilitation Research and Training Center on Disability Demographics and Statistics, 2007).

Similar prevalence rates and employment and income disparities exist globally. In the European Union (EU), for example, almost 15% of EU working age population (ages 16-64) has a disability. In that age group in the EU, 62 % of those reporting no disability, 46 % of those reporting a moderate disability and 24 % of those reporting a severe disability are in work. Almost 70 % of those reporting a severe disability and somewhat less than half of

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[2] See www.un.org/disabilities/convention/ for more information. Resources to aid in implementation of the convention have been collected by GLADNET at www.gladnet.org.

those reporting a moderate disability are inactive; among those reporting no disability, 30 % are inactive (Eurostat, 2001).

Discriminatory Workplace Environment

Another issue for workers with disabilities and their employers is the work environment itself, and whether it might be unfriendly and perhaps even discriminatory toward its workforce segment whom is persons with disabilities and also older workers. A significant factor influencing the decision to hire and retain or workers with disabilities and older workers is no doubt the culture of the workplace itself. Disability-based stereotyping perpetuates discriminatory practices and discourages workers with disabilities from remaining in or returning to the workplace. One of the stereotypes which is perpetuated is that older workers and workers with disabilities are not able to learn about new technologies and therefore be readily available as a labor source in the knowledge economy.

Claims of discrimination can be a source of information about where discrimination is occurring in employment settings and where perhaps employers can proactively address disability issues to prevent future such claims. This information can be taken from internal grievance records of specific organisations, or discrimination claims filed with local or national authorities. Some of the information found useful from such data sources are types of issues occurring, and where they occur (such as in the application or lay-off/firing processes, accommodations, harassment, etc.), and the basis upon which the claim was made (age, race/ethnicity, sex, religion, disability, etc., or further distinctions made by type of disability).

In addition, this information may be informative in looking at trends in claims filed over time, and trends in claims filed relative to other kinds of discrimination claims. Research being conducted at Cornell University illustrates how trends in discrimination claims for particular types of discrimination changed over a ten year period.[3] The strengths of examining discrimination claims as a source of information about where bias occurs in the workplace are that such an approach can assist in identifying specific issues for attention and in identifying vulnerable populations. In addition, such an approach may be useful to illustrate changes in policies and practices over time or in assessing the impact of changes in legislation, policies, and environmental factors in a given geographic area (Bruyère, 2006). [4]

For example, 328,001 disability employment discrimination charges were filed across the United States in the period 1993-2003.[5] Over these years, the number of Americans with Disabilities Act (ADA) charges ranged from a low of 24,266 charges in 1993 to a high of 32,940 charges in 1995—averaging approximately 30,000 charges per year. The annual number of ADA charges has been generally declining since 1994 (see Table 1).

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[3] Cornell University EEOC Charge Data Study; ADA and ADEA EEOC charges by issue, 1992-2003. (2005). Unpublished report. Ithaca, NY: Cornell University, ILR School, Employment and disability Institute. S. Bruyère, Principal Investigator; A. Ruiz-Quintanilla, Co-PI; A. Houtenville and S. Schwab, Consultants.

[4] In the U.S.A, employment discrimination claims can be filed either at an EEOC (Equal Employment Opportunity Commission) office) or at a state FEPA (Fair Employment Practices Agency) office.

[5] Prohibitions regarding employment discrimination against people with disabilities are covered under the Americans with Disabilities Act of 1990 (ADA); for further information see http://www.eeoc.gov/types/ada.html.

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Table 1. Number of ADA-related charges filed in FEPA and EEOC offices and as a percentage of population with work limitations, annually, 1993-2003[1,2]

Year	Number of ADA-related charges	Population with work limitations	Number of ADA-related charges as percent of pop. with work limitations
Total	328,001	140,396,000	0.234
1993	24,266	11,785,000	0.206
1994	31,322	12,737,000	0.246
1995	32,940	12,796,000	0.257
1996	31,225	12,706,000	0.246
1997	32,018	13,007,000	0.246
1998	30,934	12,820,000	0.241
1999	29,976	12,570,000	0.238
2000	28,260	12,770,000	0.221
2001	28,879	12,631,000	0.229
2002	29,602	13,474,000	0.220
2003	28,579	13,100,000	0.218

Source: Calculations by Cornell University, Employment and Disability Institute, using the EEOC IMS files, 1993-2003.

[1] ADA-related charges include charges based on the ADA alone and in combination with other statutes. The number of charges reflects the number of individual charge filings.

[2] Estimates of the population with work limitations are based on the March Current Population Survey and whether a person worked more that 52 hours in the previous year.

An examination of ADA charges filed in the period 1993-2003, by basis (i.e., disability type) provides useful information about disability areas where employers are currently having difficulty (Bruyère, Houtenville, and Ruiz-Quintanilla, in process). Table 2 shows the bases for ADA charges from 1993 through 2003. The basis cited in the most charges was "other disability," which was cited in 83,555 charges—slightly more than twice as many as the next basis—structural back impairment (44,051 charges). Rounding out the top ten bases, the next eight bases were "regarded as disabled" (27,672 charges), non-paralytic orthopedic impairment (25,761 charges), depression (18,621 charges), other psychiatric disorders (12,996 charges), diabetes (11,266 charges), heart/cardiovascular (11,394 charges), hearing impairment (9,600 charges), and "record of disability" (8,450 charges).

Table 2. Number of ADA charges, by basis, 1993-2003[a,b]

Basis	Number of times cited	Basis	Number of times cited
Alcoholism	5,022	Kidney Impairment	1,919
Allergies	2,230	Learning Disability	4,967
Alzheimer's	53	Manic Depression	5,071
Asthma	5,363	Mental Retardation	2,091
Autism	150	Missing Digits/Limbs	6,123
Blood-Other	3,469	Multiple Sclerosis	3,681
Brain/Head Injury	2,006	Non-paralytic. Ortho. Impair.	25,761
Cancer	53	Other anxiety disorder	7,486
Cerebral Palsy	1,454	Other Disability	83,555
Chemical Sensitivity	1,028	Other neurological	8,663
Cumulative Trauma	3,322	Other psych. disorders	12,996
Cystic Fibrosis	98	Other Pulmo./Respiratory	2,595
Depression	18,621	Paralysis	2,290
Diabetes	11,266	Post Traumatic Stress	31
Disfigurement	849	Record of Disability	8,450
Drug Addiction	2,530	Regarded as Disabled	27,672
Dwarfism	123	Relationship/Association	2,539
Epilepsy	5,565	Schizophrenia	1,081
Gastrointestinal	2,979	Speech Impairment	2,119
Hearing Impairment	9,600	Structural Back Impairment	44,051
Heart/Cardiovascular	11,394	Tuberculosis	159
HIV	4,775	Vision Impairment	7,489

Source: Calculations by Cornell University, Employment and Disability Institute, using the EEOC IMS files, 1993-2003.

[a] The number of charges represents the number of charges filed where the ADA was cited (i.e., those charges filed based on the ADA alone or in combination with other statutes).

[b] It is important to note that a charge may cite more than one basis, therefore the sum of citations over all basis will lead to more than total number of charges.

*ALSO OF İNTEREST İS THAT, İ*n the period 1993-2003, by far the most cited issue was discharge (179,073 charges), with more than twice as many charges as the next issue -- reasonable accommodation (79,986 charges) (See Table 3). Rounding out the top ten issues, the next eight issues were terms/conditions (62,056 charges), harassment (37,494 charges), hiring (28,075 charges), other (18,044 charges), discipline (15,452 charges), constructive discharge (12,129 charges), promotion (11,457 charges), and layoff (11,242 charges) (Bruyère, Houtenville, & Ruiz-Quintanilla, in process).

Table 3. Number of ADA charges in which a given issue was cited, 1993-2003[a,b]

Issue	Number of times cited	Issue	Number of times cited
Apprenticeship	70	Prohibited Med. Inquiry/Exam	2,078
Assignment	5,795	Promotion	11,457
Benefits	6,408	Qualification	779
Benefits-Insurance	2,974	Reasonable Accommodation	79,986
Benefits-Retire./Pension	678	Recall	2,967
Breach of Confidentiality	26	Recordkeeping Violation	651
Constructive Discharge	12,129	Refer. Unfavorable	936
Demotion	9,218	Referral	595
Discharge	179,073	Reinstatement	7,833
Discipline	15,452	Retirement-Involuntary	5,367
Early Retirement Incentive	85	Segregated Facilities	500
English Only Rule	36	Segregated Locals	18
Exclusion	627	Seniority	607
Filing EEO forms	201	Severance Pay Denied	197
Harassment	37,494	Sexual harassment	5,436
Hiring	28,075	Suspension	7,580
Intimidation	6,992	Tenure	228
Job classification	946	Terms/conditions	62,056
Layoff	11,242	Testing	446
Maternity	687	Training	2,476
Other	18,044	Union representation	1,794
Other Language Issue	44	Wages	10,166
Paternity	24	Waivers	152
Posting Notices	78		

Source: Calculations by Cornell University, Employment and Disability Institute, using the EEOC IMS files, 1993-2003.

[a] The number of charges represents the number of charges filed where the ADA was cited (i.e., those charges filed based on the ADA alone or in combination with other statutes).

[b] It is important to note that a charge may cite more than one issue, therefore the sum of citations over all basis will lead to more than total number of charges.

It is useful for American employers to be aware that claims of employment discrimination for people with disabilities have remained relatively constant since 1994, when the Americans with Disabilities Act of 1990 employment provisions came into effect for employers of 15 or more people. This indicates that people with disabilities continue to perceive that they are experiencing discrimination across the employment process. It is imperative that enterprise, policymakers, and non-governmental organisations supporting people with disabilities

become familiar with and act upon the information gained through this inquiry, such as parts of the employment process where perceived discrimination most often occurs and types of disability that appear to be more challenging for employers to accommodate.

Informational Technology and Educational Access for Youth with Disabilities

Addressing information technology accessibility issues for youth with disabilities in educational settings is a critical first step to assure equitable participation in the knowledge economy. More than six million children in the U.S. (ages 21 and under) were diagnosed with a disability and found eligible for special education services in 2004 (Abt Associates, 2006). More of these American students than ever are continuing their education after high school; between 1987 and 2003, the percentage of youth with disabilities participating in postsecondary education of any kind more than doubled, from 14.6% to 31.9%. The greatest growth has come in two-year colleges. In 1987, 3.6% of youth with disabilities went on to two year colleges, while in 2003, 20.8% did so (Abt Associates, 2006). Attention to the learning and information technology of these youth is imperative, if they are to gain equitable access both to education and subsequently to employment.

Learning disabilities are the most common disabilities among undergraduate American students who report having a disability; 29% of students with any disability have a learning disability, while 23 % report orthopedic disabilities, 16% have a hearing disability, 16% have a visual disability, and 21% of disabilities are of some other type (National Center for Education Statistics, 2000).

A 2006 Noel-Levitz survey of 231 postsecondary institutions found that 100% of four-year colleges and 89% of two-year public colleges offered online admissions applications (Noel-Levitz, 2006a). A 2006 survey of 1,000 high school juniors found that 72% had used college Web sites, that 22% had already completed online applications, and 86% said they wished to do so (Noel-Levitz, 2006b).

Colleges are becoming aware of the need for information technology and computer accessibility for people with disabilities, in some areas. In 2001, an online survey of 72 higher education institutions found that nearly all (93-95%) were deploying screen readers, screen magnifiers, and optical character recognition for computer users on their campuses. Over half the respondents in the sample had a staffer whose sole responsibility was the implementation of assistive technology. Less than one-third had a Section 508 plan[6], however, and only 22% had a documented policy regarding web accessibility. The respondents were recruited via listservs and conferences relating to accessibility issues, and so were probably among the better-informed institutions (North Carolina State University, 2004).

Web pages that do not meet accessibility guidelines can create a significant, often insurmountable, barrier to students with disabilities. When college admission and financial aid depend on access to these functions, inaccessible web pages greatly increase the potential for discrimination against students with disabilities. It is imperative that web sites offering these services be made accessible so that students with disabilities are afforded the same benefits of online applications as their non-disabled peers.

Logically, experiencing roadblocks during the college search and application process would serve as a deterrent to prospective students aspiring to attend college. In 2002, nine out of ten high school students did at least part of their college research on the web, compared with only 4% in 1996 (Boser, 2003). The trend toward more extensive use of the web is seen among

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[6] Section 508 requires that Federal agencies' electronic and information technology is accessible to people with disabilities; for further information see http://www.section508.gov/.

students with disabilities as well as non-disabled students. For individuals over age 15 with a visual impairment, 53% report access to the web and regular computer use compared with 61% among non-disabled persons (Gerber, 2002).

A Cornell University survey of Student Services leaders at two-year colleges in the U.S. found that the vast majority of these community colleges are using web-based technologies for student processes (Erickson, Trerise, Lee, & Bruyère, 2007). Only six of the nearly 700 participating colleges said that they didn't offer *any* student services online. Over 90 percent of the colleges surveyed currently offer online access to course catalogs, class schedules and online courses. Between 80 and 90 percent also offer financial aid applications, applications for the college, and course registration online. Six out of ten offered online Bursar billing services. Many of the colleges that didn't currently offer specific student services online planned to within the next two years. Of greater concern is the growing number of colleges that are only offering certain information and services online. Of the over 90% of colleges that currently offer online course registration, for example, 11 percent have made it an *exclusively* online activity. Nearly as many (9 percent) accept *only* online financial aid applications. And 5 percent of colleges are now only making their course catalogs and class schedules available online (Erickson, Trerise, Lee, & Bruyère, 2007).

A related Cornell study of community college website accessibility found that none of the community college web sites checked were fully accessible. In usability testing with blind, low-vision, and learning-disabled test subjects, people using assistive technologies to access the college's website were often unable to complete the steps necessary to complete tasks related to applying for admittance, finding courses, or accessing financial aid (Erickson et al, 2007). Community college webpages tested by the usability test subjects were plagued with unlabelled or inaccessible links and buttons and low contrast text and links. Over three-quarters of the users had difficulty in finding major content, and over two-thirds encountered problems in finding and navigating the course list and locating a specific course (Erickson, Trerise, Lee, VanLooy, & Bruyère, 2007).

In the same study, nearly all the usability testers (95%) encountered difficulties in navigating the online application forms, lost their place or were unable to save information. A similarly high number (82%) were frustrating by missing or unclear instructions in the application form, and the majority (59%) also had trouble deciphering error messages and understanding problems with their applications (Erickson et al, 2007).

Information Technology and Employment Issues for People with Disabilities

Information technology accessibility issues for people with disabilities also are pervasive within the employment process. In the United States, in 1999 amendments were made to Section 508 of the Rehabilitation Act of 1973, ensuring that the Federal government would purchase electronic and informational technology (hardware and software) which is open and accessible for people with disabilities. It also requires that individuals with disabilities, who are members of the public seeking information or services from a federal agency have access to and use information and data that is comparable to that provided to the public who are not individuals with disabilities, unless an undue burden would be imposed on the agency (Cardinali & Gordon, 2002).

At approximately the same time, Cornell University began a series of studies in both private and federal sector organizations examining disability employment nondiscrimination policies and practices, including information and communication technology accessibility and accommodations. A discussion of these studies follows.

In the study of private and public sector HR representatives conducted by Cornell University, the two most common barriers to employment or advancement of a person with a disability, noted by more than 4 out of 10 respondents, were lack of related experience in the job candidate with a disability, and lack of requisite skills and training on the part of the individual with a disability. Attitudes or stereotypes among co-workers and supervisors towards persons with disabilities was seen as the third most significant barrier among federal respondents (43 percent), and fifth among private sector respondents (22 percent). The next most often cited was supervisor knowledge of how to make accommodations (Bruyère, 2000; Bruyère, Erickson, and VanLooy, 2006a). These findings confirm the importance of equitable access to educational preparation as well as mentoring and early job experiences, for youth with disabilities. It also points to the importance of further information for supervisors about accommodation approaches, including information technology accessibility. Interestingly, in both the federal and private sectors, cost of training, supervision, and of accommodations for applicants or employees with disabilities, were least likely to be rated as significant continuing barriers, compared to other areas.

Respondents were asked if they had needed to make any of 10 specific Americans with Disabilities Act (ADA)-related changes regarding recruitment, pre-employment screening, testing, and orientation, and if so, if they had made the change, and how difficult it was to make. The majority of organizations from both sectors report having made changes in their existing recruitment, pre-employment screening, testing, and orientation procedures in order to comply with disability nondiscrimination and civil rights laws. Making information accessible for a person with a visual or learning disability, or a person who is deaf or hard of hearing, was an area reported more difficult than others, however. Respondents indicated that their interview staff are least familiar with interview considerations relating to people with visual or auditory impairments, such as using a text telephone or relay service to set up interviews with deaf or hard of hearing applicants, using a reader to assist a person with a visual impairment or learning disability, or with adapting print materials used in interviews to large print, diskette, or Braille. In the private sector, with an aging workforce, knowledge of accommodations for persons with visual and hearing impairments will become increasingly important for employers.

IT in the Workplace and People with Disabilities

Businesses are also becoming increasingly network intensive, both internally (intranets) and externally (Internet) (Schrage, 2000). A cross-sectional survey conducted by Towers Perrin of 248 executives from larger companies discovered that almost nine out of ten (86%) of these executives saw the Internet as changing business practices and processes (Towers Perrin, 2001a, b). Even at that time, nearly half (48%) expected that the growth in Internet use would result in a significant change to business practices.

The Web's influence in this area is not limited to large businesses. A survey performed at the Harvard Business School (Kanter, 2001) found that small (fewer than 100 employees) and medium (100-500 employees) businesses matched or outpaced larger businesses in the use of the Internet for internal operations such as training and receiving employee feedback. At least a third of all companies surveyed used the Web for each of the purposes asked about in the survey, ranging from attracting new customers, to purchasing, to conducting online meetings.

Use of the Internet in Applicant Recruitment

Recruiting qualified employees is a major concern for businesses. The Internet has become one of the primary resources that companies use to find employees. With millions of jobs and resumes available online the "Internet has become the most effective way to broadly disseminate information about the availability of jobs and people" (How online recruiting

changes the hiring game, 2001). Research by Goldman Sachs showed that between the beginning of 1999 and November 2000, traffic to career-oriented Web sites more than doubled, to 12.3 million unique visitors per day (Rosenwald, 2000). A July 2001 poll of 400 recruiters by Recruiters Network found that 78% felt Internet job postings were the most effective way to spend job search budgets, far outstripping newspaper classifieds (12%) and career fairs (7%) (Gill, 2001).

Job seekers have also turned to the Internet. A 1998 study performed by J. Walter Thompson's Specialized Communications Group found that 70% of all active job seekers preferred the Internet to other methods and that more than half the general public planned to use the Internet to find their next job (Conhaim, 1998). The Society for Human Resource Management (SHRM) search tactics poll (2001) found that 96% of job seekers surveyed had used Internet job postings to look for a new job. While that is a very high percentage, it is important to note that the job seekers polled had signed up for the CareerJournal.com's Job Alert list, and were therefore more likely to have used online job searching than a random sample of job seekers.

Web recruiting technology allows an applicant's job hunt to reach more widely than ever before, which can be a great benefit to someone with a mobility disability. It also creates a concern regarding access for minorities and people with disabilities, who are less likely to have a computer and Internet access (Kaye, 2000). Only 18% of the 100 most heavily trafficked recruiting sites were found to meet all Bobby Priority 1 requirements (Jackson-Sanborn, Odess-Harnish, & Warren, 2001). Given these results, inaccessible Web-based recruiting presents a significant employment roadblock for those who have disabilities that prevent them from using a primarily visually-oriented, point and click environment.

Employee Computer Use -- Results from Cornell Study

Cornell University has conducted research to examine the impact on applicants and employees with disabilities of the increased use of information technology in the workplace. Over 400 private-sector respondents to the earlier study (Bruyère, 2000) were surveyed about their organizations' use of computers and information technology in the workplace, and their awareness of accessibility issues relating to this. The majority of informants in all industries reported that most employees used computers at least occasionally. Fewer than 1 in 10 employees in finance, insurance and high-tech/ computer/telecommunications do not use computers at all, and fewer than 1 in 5 don't use computers in the public administration and service industries. Only slightly more than a third of the workforces in the manufacturing, transportation/utilities and retail/wholesale trade do not use computers at all (Bruyère, Erickson, & VanLooy, 2005).

Even in the industries with the lowest computer use, over 40% of employees spent at least half the workday on computers (40% of transportation/utilities, 42% of manufacturing, and 47% of retail/wholesale trade). Three out of five positions in public administration (60%) and service industries (60%) use computers more than half the day, and 80% in the insurance, high tech and finance sectors do so. Surprisingly, the smallest firms (less than 100 employees), reported the largest percentage of employees using computers more than half the workday (67%) (Bruyère. Erickson, & VanLooy, 2006b).

Company Use of Online Technology in HR Process

In the Cornell University study, in order to determine the distribution of online technologies in human resources within the sample, the survey included a question asking about the use of four prominent online HR technologies (online job postings, online benefits information dissemination, online benefits self service, and online employee training) (Bruyère. Erickson,

& VanLooy, 2006b). The majority of the respondents reported their companies were using each of the four online technologies to some extent. Overall, more than two-thirds reported using at least three of the online technologies, with only 3% reporting not using any. Online job postings were by far the most commonly used: nearly nine out of ten companies reported using them, and nearly half (44 %) use them "a great deal." Online benefits information dissemination was also common, and was used by more than 4 out of 5 companies; one-quarter reported using it "a great deal." Online benefits self service where an employee can alter personal benefits online was used by over half the companies, and was used a great deal by nearly 1 out of 5. The majority (63 %) of respondents also reported that their companies made use of online training, but its use was not as intensive, with only 4% reporting using it a great deal. Larger companies were significantly more likely to use these HR technologies than smaller companies, and to use them more heavily (Bruyère, Erickson, & VanLooy, 2006b).

Familiarity with Assistive Technologies

The Cornell University study respondents were asked about how familiar they or their staff were with six of the most common assistive technologies used to adapt computers or information technology applications (screen magnifiers, speech recognition software, video captioning, Braille readers/displays, screen readers, guidelines for Web design) (Bruyère, Erickson, & VanLooy, 2006b). Nearly half (46 %) were familiar with screen magnifiers, although nearly a third were unfamiliar with this technology. Approximately a third reported familiarity with speech recognition software. Video captioning was familiar to one out of four respondents, but was unfamiliar to over half. Assistive technologies designed for blind individuals were unfamiliar to the majority of respondents. Braille readers/displays were familiar to only 1 in 5 respondents, while only 16 % of respondents were familiar with screen readers. As would be expected, those who reported having made computer adaptations for employees were more likely (in most cases, twice as likely) to report familiarity with each of these technologies (Bruyère, Erickson, & VanLooy, 2006b).

Overall, only 13 % of all respondents noted familiarity with guidelines for accessible Web design, with those from larger organizations (500+) more likely to report familiarity (17 % compared to 9%). Those with experience adapting computers for accessibility were more than twice as likely to be familiar than those without this experience (19 % compared to 7%). Considering the number of U.S. business organisations utilizing Web-based HR processes, this low level of familiarity highlights an area of real concern (Bruyère , Erickson, & VanLooy, 2005).

Following up on this issue, respondents were queried about their awareness of whether any of their organisations' HR Web sites had been evaluated for accessibility for people with disabilities. Of those who had such sites, only about 1 in 10 said they were aware of an evaluation, 2 of 5 said their sites had not been evaluated, and slightly over half were unsure. Even though those with experience adapting computers for accessibility were more than twice as likely to report evaluating their Web sites for accessibility, this still accounted for only 14 % of that sub-group, compared to 6% of those without experience. Although the sample sizes by industry are small, it is interesting to note that the public administration respondents were more likely to say their sites had been evaluated (21 %) than those in other industries. This may reflect a greater awareness of governmental legislation regarding accessibility (i.e. Section 508 of the Rehabilitation Act)[7].

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[7] Section 508 requires federal departments and agencies that develop, procure, maintain, or use electronic and information technology to ensure that federal employees and members of the public with disabilities have access to and use of information and data, comparable to that of the employees and members of the public without disabilities. See http://www.access-board.gov/508.htm for more information.

Computer Adaptations Made for Employees with Disabilities

Despite the large number of respondents who were not very familiar with accessibility issues, nearly half reported having made alterations to make a computer accessible to an employee with a disability, and only 1% reported being unable to accommodate. As might be expected, larger companies were more likely to have made adaptations for employees with disabilities, because they would be more likely to have a larger number of employees with disabilities. Nearly three quarters (73%) of the largest employers (5,000+ employees) had made adaptations, compared with six in 10 medium-large companies (500 to 4,999) and three in 10 small companies (less than 500) (Bruyère, Erickson, & VanLooy, 2005).

The single adaptation reported by nearly half of those respondents who reported making accommodations was that of altering the workstation. Making computer workstations accessible to employees using wheelchairs (26%) was also common, but also smaller changes such as special keyboard trays for individuals with carpal tunnel problems were mentioned. Nearly two-thirds of the adaptations (65%) were for individuals with visual impairments, and included screen magnifiers (41%), large screens (16%), screen readers (8%) and Braille readers (6%). Special computer input apparatus such as mice, keyboards and pointing devices were mentioned by almost a third (31%) of those who had made adaptations. Voice recognition software was also mentioned by 1 in 5 respondents (Bruyère, Erickson, & VanLooy, 2005).

Needed Next Steps

If the disparities to accessing educational and employment opportunities presented by the inaccessibility of information technology are to be addressed in a meaningful and longer-term effective manner, a comprehensive approach needs to be used. Such a multi-pronged strategy must include governmental initiatives and engagement of policy makers; educational initiatives; improved employer policies and practices; economic development initiatives; involvement of local, state, and national disability advocacy organizations; and support for needed research. A preliminary brief description of some these initiatives and next steps in each of these areas follow.

Governmental/Policy Initiatives

Governments and policymakers are vital in taking the first steps to improve access to the knowledge economy for people with disabilities. The first step to improving public policy is identifying which existing policies are in place to address nondiscrimination and reviewing them for consistency and comprehensiveness across the various laws, in addressing the needed issues. When looking globally for regulatory solutions to disability educational and employment discrimination, it will be imperative to promote common approaches and patterns of efforts across various national entities (Hvinden, 2003).

Actions they can take include the development of universal industry standards for IT accessibility that go across industry sectors, housing, and transportation; the passage and enforcement of legislation regarding IT accessibility and equal access to education and employment; and the creation of educational and informational service networks to provide ongoing consultation to employers and educators on these issues.

Educational Initiatives

Preparation for the knowledge economy must be a part of the education of youth with disabilities if they will succeed in this new economic and workplace environment (O'Donnell,

2005). Actions educators and school administrators can take include: ensuring the accessibility of information technology to facilitate full participation, creating nondiscriminatory environments in course planning, programming, organisation policy, and procedures, and creating learning opportunities that enhance IT knowledge for students with disabilities (Proctor, 2005).

Employer Policies and Practices

Employment is a key aspect of participation in community life, and work is becoming increasingly dependent upon information and communications technologies. Diversity is increasingly being recognized as a key element in the long-term success of business organizations. Including people with disabilities in teams where the development and testing of technology is done, better assures that the resulting products and services from these efforts will be accessible to consumers with disabilities (Minton, 1998; Moody, Beise, Woszcyzynski, & Myers, 2003).

To ensure that people with disabilities can play a role in the workplace of the knowledge economy, employers will need to enact policies and develop best practices that facilitate their involvement. These might include: strategic workforce planning that includes people with disabilities; reviewing IT accessibility consideration, especially as they relate to recruitment and other HR approaches; ensuring equitable access to training, developing an accessible IT procurement strategy; and the judicious use of flex-place options, which can be reasonable accommodation but can also be isolating and prevent full participation.

Economic Development Initiatives

Economic development initiatives to support the inclusion of people with disabilities in the knowledge economy might include are imperative to engage this population in the needed training and subsequent workforce participation in the knowledge economy. Some of the initiatives which can be pursued include: support of employer-provided degree programs, on the job skills training, internships, and school-based mentoring programs; funding of partnerships between enterprise educational institutions dedicated to training/upgrading labor force; emphasis on programs for workers with disabilities/aging workers; including disability advocacy organizations; and partnerships with education and enterprise networks to provide IT accessibility consultation, conduits for students and employees with disabilities, and a network for community-based supports for housing, transportation, health care, and related services.

Needed Research

To truly bridge the digital divide for people with disabilities and facilitation full participation in the knowledge economy, support for continued research is needed. The information and communication accessibility needs of people with disabilities must be a consideration in the development of national and international information technology development. A truly global dialogue is needed about common goals in IT accessibility. Only with such continuing conversation about these issues and resultant supporting research will we be able to identify common standards of IT accessibility as well as measures of their usability effectiveness that are found in multiple settings and across countries (Klironomos, Antona, Basedekis, & Stephanidis, 2006).

Research is also very much needed to identify proven national public policies and workplace practices that maximize inclusion for people with disabilities that can be supported globally. Research is needed to assist us in identifying the critical elements of a truly effective global informational strategy which will minimize bias and promote the interests of disability populations worldwide.

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