

Web, Mobile and Computer Related Model to Bridge the Disability Digital Divide in Sri Lanka

N. Wedasinghe

Faculty of Graduate Studies
General Sir John Kotelawala Defence University
Rathmalana, Sri Lanka
nirosha@kdu.ac.lk

R. Wicramaarchchi

Departments of Industrial Management
University of Kalaniya
Kalaniya, Sri Lanka
ruwan@kln.ac.lk

Abstract— According to the statistics of the World Health Organization 15 percent of the world population lives with some kind of a disability. This statistic further indicates that 10 percent of the Sri Lankan total population also has some kind of disability. Sri Lanka suffered three decades of civil war. As a result no of disabled people gradually increased. Most of the civilians disadvantage of getting benefits of ICT during that period. As a result the war ending in 2009, the government strategies for the future were directed more on the Development of the country. Sri Lanka ICT literacy rate was increases 8% in 2005. It was increases up to 40 % in 2013. Government focuses to be 75 percent by the year 2015. The motivation behind this research is to overcome disability digital divide in Sri Lanka and facilitate more opportunities for them to enjoy in the digital world. The objective of this study is to propose a Web, Mobile and Computer related ICT model to bridge the disability digital divide gap in Sri Lanka and improve the quality of life of the differently abled community in Sri Lanka. This study involved Literature survey, and many different data gathering techniques mainly group discussions, interviews and site visiting more than 107 samples were interviewed to propose the model. Sri Lankan Participants for this study were inclusive of informal interviews with different communities, different disabled categories and different geographical locations. Study findings were indicated that most of the Sri Lankan differently abled community is not aware and not benefited from globally available modern technologies available for this community. This model is basically proposed based on the initial study has done in phase one to eliminate Disability Digital Divide in Sri Lanka and this paper is a revised model proposed by the same author. This new model includes guidelines to eliminate categories under disability digital divide in Web services, Mobile devices, Computer devices. This paper further proposes to consider the areas in ICT to be considered and the responsible authorities and stakeholders who need to take the initiation to eliminate the disability digital divide in Sri Lanka.

Keywords— *Digital Divide; Persons with Disability; Sri Lanka Disability Divide; Disability Digital Divide*

I. INTRODUCTION

Information Communication Technology can play a vital role for the life of billions of differently abled around the globe. A disabled person can take advantage of this technology. For Example locate necessary information without depending on others, do banking transactions through online Banking , sending and

receiving messages to communicate with different people via on-line chat rooms, Telemedicine for their health needs, play computer games, specially visually handicapped read computer screens via screen recorders and many more advantages could be gathered using ICT.

Different disability groups and different organizations define disability with different definitions. These interpretations are influenced by different interpretations influenced by historical, social, legal and philosophical concept. In additions to that, disability models also have different disability definitions. According to the MDRC [1] there are different models of disability such as social model, medical model, expert or professional model, right based model, charity model, religious model, economic model, customer model and rehabilitation model of disability. According to the different definitions it is indicated that this community is a disadvantaged group in the society. ICT access by this community also considered as a common problem in the world.

According to the Internet world statistics [2] states that there is a divide of access of information in the world. It could happen due to many reasons and disability's also one aspect. This divide is known as disability digital divide. According to the definitions of the inventor and director of www Tim Berners Lee states that "The power of the web is in its universality. Access by everyone regardless of disability is an essential aspect".

Different solution models have been proposed by the different researchers to solve this digital gap. According to the above different models these digital divide solutions basically depend with the culture, political influences, social view point on differently abled community and the technological usage by the country. It is proved that by nations to nation it varies, therefore the objective of this study is to propose an ICT model to bridging the disability digital divide gap in Sri Lanka and to improve the quality of life of the differently abled community in Sri Lanka.

II. METHODOLOGY

Research strategy used for this study is a mixed approach. Field and literature surveys have been conducted to do this research. The first phase of this research literature survey was conducted to identify the main current problems and issues faced by the disabled community in the world. These findings were categorized into four phases such as web access related issues, Mobile devices and services related issues and computer devices related issues.

This second study was carried out to identify the issues faced by the Sri Lankan disabled community. Therefore this study involved different data gathering techniques mainly group discussions, interviews and site visiting to identify SL situations. Sri Lankan participants for this study were taken with informal interviews with different communities, different disabled categories and different geographical locations within the Western province.

Collected data were analyzed based on qualitative approach according to three themes. Analysis techniques used in this research were compared and contrasted among the literature survey data with empirical study data. In addition to that frequency counts were used and data were presented in graphically a table according to the three themes.

III. LITERATURE REVIEW

According to the literature, the digital age is a period in human history characterized by the change from traditional industry, that the industrial revolution brought through industrialization, to an economy based on information computerization. According to the Dobransky [3], the increasing spread of the Internet holds much potential for enhancing opportunities for people with disabilities. However, scarce evidence exists to suggest that people with disabilities are, in fact, participating in these new developments. Will the spread of Information technologies (IT) increase equality by offering opportunities for people with disabilities? Or will a growing reliance on IT lead to more inequality by leaving behind certain portions of the population including people with disabilities? Considering the above arguments, it is proved that disabled people are not having equal opportunities to accessing information technology.

In the United Kingdom, for example, people were either discouraged or not actively encouraged to enter the workforce. In 1958, the British government realized the potential economic benefits in having people with disabilities in the workforce. As a result, sheltered workshops were introduced and shared accommodation was encouraged. Other countries, including Australia, Implemented similar policies shortly after the British Government initiative. Sri Lanka has not had any disability related Government policies at that time.

As a result for the request by the disability movement in Sri Lanka from the government for a national policy on disability was approved in 2003. This was the initial consideration for this community. Later in 2012 a National Action Plan for the disabled was taken into consideration in Sri Lanka.

The Sri Lanka has taken many initiatives to bridge the gap of the disability digital divide. ICTA the government authorized body on ICT in Sri Lanka has initiated some projects to bridge the Sri Lankan digital divide. According to the Dewapura [4] ICT literacy was 4 % in 2003, in 2013 it increased to 40 %. ICTA offered its fullest co-operation for the rehabilitation and reconstruction work in the north and east which suffered more due to the war. e-Sri Lanka ICT development project revamp and continue e-Sri Lanka development initiations under the name 'Smart Sri Lanka'.

IV. FINDINGS

Factors contributing to the for digital divide according to the literature survey result [5],[6],[7],[8],[9],[10] and many researchers indicated that globally many reasons caused the digital divide. High impact considerations are discussed comparatively with the Sri Lankan situation.

A. Factors Contributing for Digital Divide

- Country Telecommunication Backbone;

Insufficient infrastructure is one of the major reasons behind the widening the digital divide. Most of the rural and remote communities do not have telecommunication infrastructure to support any major ICT Project to the masses. In order to provide access to all segments of the population, different projects should start immediately in rural area as well as in urban areas, such projects should include as Fiber optical link, for far and unreachable area wireless local loop could be an option. High Speed Internet connectivity should be subsidized to the less privilege individuals. Such infrastructure initiatives become a success, when public sector joins hands with the private sector projects.

In Sri Lanka until last 15 years 'Sri Lanka Telecom' was the main fixed telephone provider for the country. Customers have to stay around two years to get a telephone line .But when the government opens the private sector entrance (Suntel and, Lankabell) to the Telecom .market, things changed and country infrastructure changed in a significant manner. As a result many more Nanasala telecenters provided Internet facilities for the disadvantaged group in the country.

- Socio Economical Factors

Socio Economical Factors have a great influence on the Digital Divide, low income, minorities people with disabilities, women and senior citizen who have socio

economical disadvantages are the worst effected stakeholder of the digital divide. It is very unlikely that a poor disabled person has an internet access at his or her home. The Digital Divide can be reduced when the economic conditions of the stakeholder improves.

As in other countries there is no such difference in Sri Lanka. ICTA agency developed Nanasala ICT Community centers to increase the ICT literacy rate. It increased within 9 years from 4 % to 40 %.It is again significant improvement in ICT literacy.

- *Cost of Computer Accessories and Internet connectivity*

Even countries where Telecommunication infrastructure is adequate the cost of computer accessories and Internet connectivity is one of the major issues.

Providing low cost technologies for this disadvantaged community is important. In Sri Lanka hardware importers short term used computers from developed countries and sell to the normal users. According to [5] recommendations to combat the issue of cost is to reuse recycled computers, easy installment plans, import of cheap laptops and computer accessories. Priority should be given to public libraries, school and vocational training centers for disabled where maximum advantages can be delivered with minimum cost. In order to increase the connectivity Internet Service Providers (ISP's) should be heavily subsidize and ensure that these ISP's must provide good service at a reasonable cost.

- *Awareness and Social Issues*

Attitude of society towards lesser privileged people with disabilities are not very encouraging, every disabled person has a right to access information and communication services. In order to break such attitude and cultural norms the media should play its role by telecasting short teleplays and advertisements.

Sri Lanka is a country which suffered from 30-years war and as a result most civilians in the north and east and large no of Sri Lanka civil and security personnel were not benefited by getting ICT.

- *Physical Access*

Physical access to ICT Facilities is a major concern for people with disability, especially in rural areas. Currently most of the facilities are not disabled friendly, people with disabilities face great difficulty during travelling. In order to benefit from any public sector project, existing building or new project should incorporate building code for accessibility especially in public areas like Libraries, Schools, and Colleges and Universities.

In Sri Lanka modern Buildings and other construction are concerned all with these above aspects. But unfortunately Open University of Sri Lanka library does not support the services. It is evident that old buildings have no such facilities.

- *Language Barrier and Digital Divide*

Language is also a key barrier which significantly affects the Digital Divide. Countries where English is not a mode of education, this barrier has affected information access, even though language translation facilities are there in the form of different translation software, huge information resources are not fully accessible, because of the attitude toward learning a new language or the lack of interest in using technology to translate information. One other reason for inadequate access is the lack of good translational software. One of the possible solutions for this issue is to teach English to people with disabilities using special Language Laboratories; The other possible solution is to provide translated information resources in different local and regional languages.

According to the authors two solutions providing English and Sinhala translators could be more effective in Sri Lanka. According to the study findings more than 85 % of them would like to have mother language translated facilities. It is specially among the Blind users.

B. Digital Divide among Different Disability Groups

- *Digital Divide for Learning Disabilities*

Traditional learning resources are not adequate for this segment of the disability group. In order to harness ICT for people with Learning disabilities the teacher should be well trained in new teaching methods, which should be designed to keep the need for special people in mind, specially the content of these resources should reflect cultural and lingual aspects. Information technology can provide access to new state of the art resources in the form of easy interactive websites for people with learning disabilities in the comfort of their home. According to the findings indicated in Sri Lanka there are very few special trainers available. The Open University of Sri Lanka and Kelaniya University have a special Unit for this purpose and very few research articles were published under this category.

- *Digital Divide for Blind*

Digital Divide for blind or those who have visual impairments, little initiation has been done to bridging the Digital Divide among them. In this area a lot of research is required. Microsoft is providing many more facilities and more open source software are providing facilities but the issue identified in this research indicated that use of technology among the blind users at a lower level. There are many reasons found for this, such as they are educational level, motivation to the technology usage, social and political background, technology usage before they are became blind, financial background.

- *Digital Divide for Aphasia*

Aphasia is a form of communication disability, which includes different degrees of disabilities in verbal expression, listening comprehension, reading and writing.

Aphasia is kind of disability due to physiological and cognitive impairment. A Few symptoms and sign of Aphasia include inability to speak words, comprehend speech, read or write. In certain traditional situation these kinds of disabilities may cause frustration and anger. These different degrees of communication disabilities may cause a social barrier for the individual to communicate in ordinary situations. In this research there weren't many participants found under specially this category. Due to the other disability caused during the humanitarian operations they fall into this group. But research indicated that after 2009 less people were disabled. Through ICT it is possible for people with Aphasia to communicate and perform daily routine task. The open university of Sri Lanka plans to incorporate ICT training in the academic curriculum. The requirement for ICT training is not very different from those of non-disabled people except some modified keyboards, mouse and screen are essential, together with special techniques and mode of delivery.

The above research findings discussed under the first phase were literature findings compared with the field survey conducted during the period from August 2012 to December 2013 Ranaviru Sevana Ragama and interview discussion done Abimansala Anuradapura and randomly found participants in Sri Lanka Security forces and Different University researchers.

Findings for the second phase of this literature research were to identify the globally available technology for this community. Facilities were divided into three main ICT areas including web services, Mobile devises and computer devises. Result of phase 01 shown in the Table 1.

TABLE 1: ICT PRODUCTS AND SERVICES AVAILABLE FOR DIFFERENTLY ABLED COMMUNITY IN GLOBE –LITERATURE SURVEY FINDINGS

| Available Web Services(Internet) for disabled users | Available Mobile devisers for disabled users | Supportive Computer Devisers and others Services for disabled users |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Websites: online educational courses, social networking, shopping • Captioned telephone (relay) • Telework: online jobs and training, virtual collaboration • Telemedicine and e-health Sign language interpretation over the web (Video Relay Service, Video Relay Interpreting) • Chat systems: VoIP, audio, video, text, sign | • Smartphones and Tablets • SMS • Emergency service access – voice, text and sign language • Captioned telephone (relay) • Mobile banking services | • Accessibility software: screen reading, voice to text, screen typing • Captions (closed and open) [eg. Youtube] • Captioned telephone (relay) • Accessible e-books and e-documents • Gamified apps for special education and recreation • Open source software • Hearing Aids • Smart homes • Artificial intelligence – robots, digital human |

| | | |
|------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| language, text to avatar, real-time text | | modeling, emotion recognition • Emergency communication response – satellite, • “Assistive Bridge to Safety”: emergency call subscriber servicexvi (911, 112, 000, etc.) • Speech to text, text to speech, speech/text to sign language • Natural User Interfaces • Emergency service access – text and sign language relay services |
|------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

According to the above findings it is indicated that there are different technologies and services offered by the ICT. According to the literature indicated that different tools and technologies are available for differently abled community but there are also different barriers faced by them due to disability digital divide.

In order to identify the problems faced by the Sri Lankan disabled community a next part of the research was conducted. These findings are summarized in the following Table 2. According to the above findings proposed some guideline to follow were given in the solution column in the Table 2 Solution column.

TABLE 2: SOLUTION MODEL TO ELIMINATE DISABILITY DIGITAL DIVIDE

| Highest Priority Technologies | Problems faced by differently abled community in Sri Lanka |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Websites: online educational courses, social networking, shopping | Most of the web sites are not supporting on line educational courses for Differently abled community |
| Telework: online jobs and training, virtual collaboration | Not providing any online Jobs for this community and Not having Special training for them. Virtual collaboration is low among the community |
| Telemedicine and e-health, Sign language interpretation over the web (Video Relay Service, Video Relay Interpreting) | Per capita income is low among the community. Therefore this benefit is not much popular among them both Telemedicine and the Video relay Service. |
| Chat systems: VoIP, audio, video, text, sign language, text to avatar, realtime text | Use of Chat systems are comparatively higher than the telemedicine and video relay services |
| Smartphones and Tablets | Cost of smart phones are high and this community is reluctant to use some high technology sometimes touch systems are complicated to them comparing push button system. |
| Mobile banking system | This technology is not popular among the Disabled community |

| | |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| | due to the functions are not specifically concern for disabled community concerns. eg. Screen large Facility, Voice output |
| Accessibility software: screen reading, voice to text, screen typing | Most software's not in Sinhala or Tamil Language. English is not native language and not popular among the Sri Lankans |
| Accessible e-books and e-documents | Most books in libraries are not as an e-books version. Therefore people face difficult in reading books. |
| Open source software | Not popular among Sri Lankan community therefore trainers are not train this community to use low cost open source software. |

C. STAKE HOLDERS INVOLVEMENT TO ELIMINATE DISABILITY DIGITAL DIVIDE IN SRI LANKA

In order to implement the above proposed solutions one party cannot be done alone. Therefore it is necessary to work together with different stake holders. They are Government Institutes such as Ministry of Social Services in Sri Lanka, Sri Lanka Foundation for the rehabilitation of the disabled(SLFRD), Nanasala Centers in ICTA Agency, Rehabilitation centers, Private and public sector banks, Social welfare centers, Private and public sector banks, Social welfare centers, Vocational School(Deaf and Blind school),Inland revenue departments, Software developers and leading ICT Organizations located within the country, Medical Associations, Insurance Companies, Telecommunication sector service providers and Private and Public sector university researchers and other researchers who are involved in the disability related areas. The relevant potential Partners details are given in the Table 3.

TABLE 03:SOLUTIONS AND POTENTIAL PARTNERS

| Highest Priority Technologies | Solutions | Potential Partners |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Websites: online educational courses, social networking, shopping | Develop more online educational courses benefits for disabled community | ICTA and Web Developers |
| Telework: online jobs and training, virtual collaboration | Develop a Popular online Job cites to access for disabled community. Provide online training for them and arrange some virtual collaboration among them | ICTA, University research units and Ministry of Social Work |

| | | |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Telemedicine and e-health, Sign language interpretation over the web (Video Relay Service, Video Relay Interpreting) | Develop national level program for Telemedicine and e-health and sign language interpretation with Sinhala and Tamil languages | Sri Lanka Medical Association, Government and Private Medical Hospital Administration authorities |
| Chat systems: VoIP, audio, video, text, sign language, text to avatar, real-time text | Develop some awareness program the community to develop the above services. | This could be implemented via projects of ministry of Social Welfare and other NGO's |
| Smartphones and Tablets | Provide low cost Smartphone and tablets and train them to use these tools to use in their day to day life | This could be done by Telecom Service providers in the country |
| Mobile banking system | Add some features to text to voice converters and text enlarge facilities in current mobile banking systems | All the public and private sector bankers |
| Accessibility software: screen reading, voice to text, screen typing | Encourage young researchers to develop more user friendly accessibility software. | Software developers and Researchers who interested |
| Accessible e-books and e-documents | Convert many university library books and other important books to accessible way for blind readers. | Sri Lanka Library Association and translators |
| Open source software | Encourage and establish national level program to use low cost open source software. | ICTA |
| Speech to text, text to speech, speech/text to sign language | Develop Sinhala and Tamil language support speech and sign language converters. | Sri Lanka Foundation for the rehabilitation of the disabled(SLFRD) |

V. CONCLUSION

This study has been done to find the solutions to bridging the gap of disability digital divide in Sri Lanka. The objective of this study is to propose an Enhance version of ICT solution model to bridging the disability digital divide gap in Sri Lanka and to improve the quality of life of the differently abled community in Sri Lanka. According to the

findings ICT has provided many technologies for disabled people globally including web services, mobile services and computer devices. According to the findings indicated the Sri Lankan differently abled community has not used these tools and techniques. Therefore the solution listed provided need to implement at Government level, University level and other public and private sector authorities.

D. REFERENCES

- [1] Michigan Disability right Colition (MDRC, "Model of Disability" <<http://www.copower.org/models-of-disability.html>>, 2012
- [2] Internet world statistics, "The Digital Divide, ICT and the 50x15 Initiative"< <http://www.internetworldstats.com/links10.htm>>, 2013
- [3] K. Dobransky, E. Hargittai, "The Disability Divide in Internet access and use",<<http://digitalinclusion.typepad.com/digitalinclusion/documents/dobransky-hargittai-disabilitydivide.pdf>>, 2012
- [4] R. Dewapura, "Steps forward for fulfilling challenges of 'Mahinda Chinthana' Vision for the Future: ICTA CEO"< <http://www.ft.lk/2013/12/24/smart-sri-lanka-revamped/>>, 2013
- [5] R. Hussain, S W A Shah, S Arif, M. A Sikander, "Policy Guidelines to Bridging the Digital Divide for People with Disabilities" <[http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%201\(12\)2711-2716,%202011.pdf](http://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%201(12)2711-2716,%202011.pdf)>, 2011
- [6] S. Balaram, "Universal Design: A new paradigm". <<http://www.ncpedp.org/access/isu-design2.htm>>, 2004
- [7] Disabled Peoples International (DPI), "Draft India Report" <www.dpi.org/en/resources/publications/documents/india.doc>, 2004
- [8] Disabled World News, "Definitions of Disability a word used in daily conversations that holds different meanings for different people" <<http://www.disabled-world.com/definitions/disability-definitions.php#ixzz2PKThh9bP>>, 2009
- [9] S. Erb, B. Harris-White, "Outcast from social welfare: Adult disability, incapacity and development in rural south India. Bangalore: Books for Change", 2002
- [10] J. Gashel, The state of the law on technology and the blind: What it is and what it ought to be < <http://www.nfb.org/bm/bm00/bm0001/bm000105.htm>>, 2004
- [11] E. Gerber, C. Kirchner, Who's surfing? Internet access and computer use by visually impaired youths and adults. Journal of Visual Impairment & Blindness, 95(3), 176-182, 2001
- [12] G. Goggin, C. J Newell, Digital Disability. Rowman & Littlefield: Lanham MD, 2003
- [13] World Stats, "Asia Marketing Research, Internet Usage, population Statistics and Facebook Information", < <http://www.internetworldstats.com/asia.htm#lk>>, 2012
- [14] Internet world statistics, "The Digital Divide, ICT and the 50x15 Initiative" < <http://www.internetworldstats.com/links10.htm>>, 2013
- [15] Information Technology and Communication Agency, "e srilanka project", <<http://www.icta.lk/en/e-sri-lanka.html>>, 2012
- [16] S. B. Kretchmer, R. Carveth, "Analyzing recent Americans with Disabilities Act-based accessible information technology court challenges", <<http://www.rit.edu/~easi/itd/itdv09n2/kretchmr.htm>>, 2004
- [17] S. McGrane, "Is the web truly accessible to the disabled?" < <http://www.cnet.com/specialreports/0,10000,0-6014-7-1530073,00.html>> 2000
- [18] E. Nora, "Framing disability issues in local concepts and beliefs" <<http://www.dinf.ne.jp/doc/english/asia/resourc/apdrj/z13jo0300/z13jo0303.html>>, 2000
- [19] G. Pike, Disability access and the Internet. *Information Today*, 20(2), 19-20, 2003
- [20] Sri Lanka Telecommunication authority, "Statistical Overview" <<http://www.trc.gov.lk/statistics/statistical-overview.html>>, 2012
- [21] M. Warschauer, "Demystifying the Digital Divide. *Scientific American*", 289(2), 42-47. < <http://www.itu.int/osg/spu/ni/digitalbridges/presentations/02-Cho-Background.pdf>>, 2003
- [22] N. Wedasinghe, R. Wicramarachchi, "ICT Model to overcome the disability digital Divide", International Journal of Information & Computation Technology, Vol4 (2) 2014. ISSN 0974-2239, 2014
- [23] World Health Organization (WHO), "vision 2020 the right to sight" <http://www.who.int/blindness/Vision2020_report.pdf>, 2006