Building digitally inclusive differently abled community in Sri Lanka: an Information and Communication Technology (ICT) policy framework

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Abstract— Digital inclusion (DI) is an ability of individual and groups to access and use information communication technology. In the Sri Lankan context, it is a problem among disabled people. This study investigates influencing factors of digital inclusion in Sri Lankan disabled community. Research methodology consists of a survey done at Ranaviru apparels Yakkala, Sri Lanka in the phase one of this study. It interviewed 180 disabled people who work at this institute. Descriptive statistic method was used for data analysis. According to results, current website development issues, difficulties in software accessibility, human perception on technology, financial difficulties to purchase and use of equipment indicated as major issues. A multidimensional framework is recommended to overcome issues. Standardization of web and internet facilities, concentration on user friendliness in software development process, infrastructure development, social and cultural changers, financial support for disabled people and special training and education on technology are recommended in the framework. This framework can be considered as a tool for building digitally inclusive differently abled community in Sri Lanka

Keywords— **Disability Digital Divide, Digital inclusion,**

I.   INTRODUCTION

A.   Background to the Study

Accessibility issues for disabled people are a pertinent issue take into consideration in the modern globalised world. In Sri Lanka also this is a influencing topic because many people suffered due to road accident and three decade of civil war. In Sri Lankan civilian who was born without any physical disability became disabled because of civil war in the country. This adds a severe disadvantage for the Nation. Due to the disability issue many people are getting disadvantage of accessing equal opportunities in the country. This is specially happen when they are using new technologies in their office work and maintaining social relationships and accessing public infrastructure. County policy makers are considering overcoming these issues and ensuring that all citizens are enabling access to new digital technologies.

Objective of this study is to propose a framework to overcome issues which influence for digital inclusion among Sri Lankan differently abled community.

This research basically divided into three different research questions. First question is to finds out what are the main factors influencing for digital inclusion among differently abled community. Second question is to find out how to overcome the above identified problems and issues. Third question is to finds out how to validate the propose solutions.

Outcome of the research propose a framework and validate method to overcome the digital inclusion issues in Sri Lanka.

II.   LITERATURE REVIEW

A.   Definitions

Research on digital inequality studies how different social groups access technologies and how this access contributes to offline advantages and disadvantages (Chen, 2013). The use of technology to communicate has become an essential and socially acceptable aspect of most people's lives and it is becoming increasingly difficult to distinguish between the "digital world" and the "real world" (Helsper, 2008; Ritchie & Blanck, 2003). Hence, Digital Inclusion is an increasingly important social issue, reflecting imperatives, opportunities, and considerations about human rights, equity, issues of identity, language, social participation, community and civic engagement, and opportunity pertaining to the digital world (Castells, 1997; Warschauer, 2003).

Disability

According to the Charlton (1998) and Driedger (1989) study disability is complex, dynamic, multidimensional, and contested. Over recent decades, the disabled people's movement together with world report on disability numerous researchers from the social and health sciences– have identified the role of social and physical barriers in disability (Barnes, 1991). More recent thinking around disability indicates that the identification of deficits should be integral to the identification of necessary support people require to overcome these challenges and that people's strengths should also be highlighted (Schalock et al., 2010).

According to the Sen(2009) Disability is a development issue, because of its bidirectional link to poverty: disability may increase the risk of poverty, and poverty may increase the risk of disability. This disadvantage group of community also face some difficulties of access computers, mobiles and Internet. It causes for many reasons such as poverty, lack of awareness, language issues, Social and ethical background and lack of Interest.

Digital Divide

The exclusion of people with disability from the online world has been referred to as one important component of the "digital divide" (Dobransky & Hargittai, 2006; Warschauer, 2003).People with disabilities are considered likely to be able to make especially fruitful use of the online world to help overcome disabling barriers they face caused by societal attitudes, organisation, and structuring which mean that their differences, for instance physical, sensory, intellectual or psychological impairments, are not adequately considered and so they are discriminated against. For example: a person with considerable physical impairments can pursue online education meaning there is less need to leave home; a person with a significant visual impairment can gain access to documents by downloading them and converting the text to speech; a person with a learning disability can socialise and make or maintain friendships from home. Sadly though, disabled people, because of poverty, lack of social support or other reasons, frequently lack the means to get online and if they can, may not be adequately equipped or supported (Chadwick et al., 2013; Hoppestad, 2013).

According to the Roger et.al(anon) Digital divide is a latest evocative term that refers to differences in access to uses of information technology that are correlated with income, race and ethnicity, gender, age, place of residence, and other measures of socioe-conomic status. According to them some people have the most powerful computers, the best telephone service and fastest Internet service, as well as a wealth of content and training relevant to their lives. Another group of people do not have access to the newest and best computers, the most reliable telephone service or the fastest or most convenient Internet services. The difference between these two groups is called the Digital Divide.

Digital inclusion

Crandall and Fisher (2009) suggest digital inclusion is the rallying cry of the twenty-first century. They claim that digital inclusion goes beyond access to computers and the internet for all, regardless of physical, cognitive, or financial ability; it means technological literacy and the ability to access relevant online content and services. Hache and Cullen (2009) extend the definition by arguing that digital inclusion is the process of democratization of access to Information and Communication Technology (ICT) in order to allow for the inclusion of the marginalized in society. They claim that digital inclusion should be seen as a wagon to social inclusion that ensures individuals and disadvantaged groups have access to the skills to use ICTs, further indicating these individuals will be able to participate in and benefit from electronic-mediated, growing knowledge within an information society.

III.   METHODOLOGY

This research examines the factor need to consider digital inclusion among differently abled community. Therefore literature survey has conducted in the initial stage of the research. Then it is finding out how to overcome the problems and finally it discusses how to implement the solutions and validate them. The methods used to collect and analyse data are discussed below.

A. Research Strategy

This research consists of basically a literature study. The core construction of this model are adapted from the theory of Technology Acceptance Model(TAM).Data Sample collected for this study include with literature behind the disability digital divide in the globe, social construction of disability, the development of information technology and internet related technology through a literature survey and global and Sri Lankan corporate policies related to information technology and web accessibility through literature and Interviews had with public and private sector organization. In order to identify real requirement of differently able community in relation to Information Technology, interviews were conducted with a range of disabled people who effected from Sri Lankan civil war.

B. Data Collection

Data collected in this study via an observation and interviews and literature study. Researcher has model the solution basically initial survey conducted at Sri Lanka Army CLI, unit Panagoda. Structured interviews were conducted. This study interviewed 314 differently abled people using a non-probability sampling method such as convenience sampling. Age group of the participants was between 20 to 50 years old. Participants for this study were selected from different communities, disabled categories and various geographical locations. Data is collected in under the different levels of technology usage under the three themes such as basic, intermediate and advance.

In the second phase of this study conducted at the Ranaviru Apparel Yakkala Branch. Study conducted with 180 disabled employees. Structured interviews were conducted. Participants for this study were selected again from different Age, Type of Work, Gender, Living arrangement, Employment status, Management Level and Income.

Both of these initial study result focuses to model the solution framework and propose validation method in this study.

C. Data Analysis Framework

Table 1: Different type of digital inclusion among differently abled community in Sri Lanka

Notation	Type of Accessibility	Variable Description
B1	Basic	Telephone Use
B2	Basic	Web Access – Information

		Search and Email use
B3	Basic	Computer Use
I1	Intermediate	Office application Use
I2	Intermediate	Multimedia use
I3	Intermediate	Screen reader Software use
I4	Intermediate	Social media use
A1	Advance	IT Administration
A2	Advance	S/W Design Development related
A3	Advance	High-tech S/W Use (Eg. CAD/ CAM Operations)

In the second survey has been more focuses on in-depth analysis of the factors influence for digital inclusion. The main factors divided into three main dimensions. They are perception on technology, technological factors and other inhibiting factors. They are given in the below Table 2.

Table 2: Factors influencing for digital inclusion

Perception on Technology	Technical problems and issues	Other inhibiting factors
Income(PI)	web standard issues(TW)	Cost of Software Technology(OC)
Education(PE)	Software incompatibility/user friendliness (TS)	Lack of Awareness(OLA)
Desire for learning(PL)		Lack of Direction(OLD)
Entertainment(PEN)		Lack of Skills(OLS)
Culture(PC)		Lack of resources(OLR)
		Lac of Training(OLT)

Collected data were analysed based on qualitative approach according to thirteen themes. Analysis techniques used in this research were co-relation on the above factors on disability digital divide. Factors analysed based on the three main viewpoints including perception on technology, Technical problems and issues and other Inhibit factors.

In order to identify the factors affecting to digital inclusion factors classify under three viewpoints. The first theme is perception on technologies. Under this five main factors were taken into consideration. Such as person income, education background, personnel interest on learning new technologies, use of technology to watching films, listing music and other entertainment activities. Then, it considers how the person culture effects to disability digital divide.

Next dimension of the factor analysis focuses on Technical problems and issues. Basically it discusses web standard issues and software incompatibility or the friendliness of the software.

Finally, it concerns the other inhibiting factors which causes for digital inclusion such as cost of software technology. Awareness of the technology, Use only some basic technologies without proper direction. Some people have proper direction but due to disability they suffer with have lack of skills. Next it considers the resources issues. Most of the disabled users are facing with some financial difficulties. Therefore, most of the assistive technologies cannot be purchased.

IV. RESULT AND DISCUSSION

Descriptive statistics of the sample, the general information of differently abled community (age, experience in technology), and the other details are reported in Table 3.

Table 3: Use of Technology

Description	Respondent	Percentage
Telephone Use	252	98 %
Web Access	150	58 %
Computer Use	155	60 %
Office application Use	131	51 %
Multimedia use	28	11 %
Screen reader Software use	4	0 %
Social media use	10	0 %
IT Administration	2	0 %
S/W Design Development related	1	0 %
High-tech S/W Use	0	0 %

According to the descriptive statistics three main areas were taken into consideration such as current ICT knowledge, Relevance of IT for job related activities and Interest of ICT for future needs. Result of the study indicated that the level of Current ICT Knowledge is high among the age 25 to 28. Reason for this could be that younger generation is using more smart phones and they are likes to incorporate new technologies. Adaption level is high among this community.

English language issues among this community can be considered as a significant issue. 90 percentage of the participant had English language issues and they are working in Sinhala language. Therefore, majority are having language barriers to use technology. Therefore, most of them are in the medium level . Most of the computer users are using office package in day today life at the same time some participants in young age like to use innovative technology. But employees who are closer

to retirement age do not like to learn new technologies. Their ambition is to have their pension and stay at home. But they are interested in giving IT education to their children rather than learning themselves.

On the other hand according the findings social media usage is 0% among the community. Restriction of social media with in the office hours and office computer are causes for this result. Most of them do not have a computer at home and as a result less usage of social media among the community.
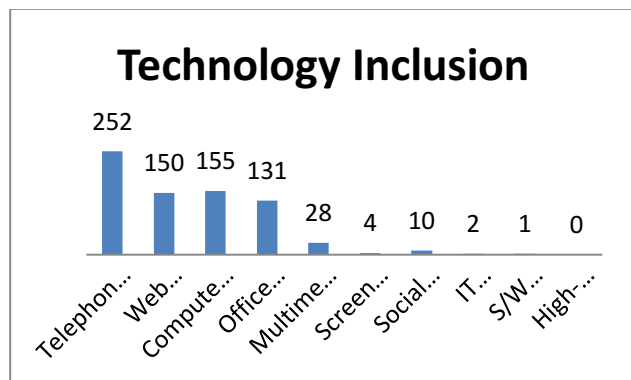

Figure 01 : Technology inclusion

Factors influencing for digital inclusion

In the next survey conducted at the Ranaviru Apparel Yakkala mainly focuses the factors that are influencing for digital inclusion among the disabled community. Descriptive statistics are discussed in the Table 4.

In this study different type of disabled participant were interviewed. It was included with 53 people with having serious difficulties in eyes, 05 hearing problems, 06 people with upper Limbs and 06 with lower limbs. In addition to that 107 people with different complications of disabilities were involved. All together 177 participants were taken in to this research.

Table 4: Descriptive statistics of factors influencing for digital inclusion

Age	18-25	25-35	36-45	>45
	23	90	58	6
Type of Work	Admin		Operational	
	19		158	
Language	Sinhala		Tamil	English
	177		-	-
Gender	Male			Female
	175			2
Leaving Arrangem ents	With Patents			112
	Shared accommodation with friends			7
	With Partner			41
	Living alone			1
	In a rehabilitation centre			15
	Healing Home for War heroes			1
Employme nt Status	Full Time			177
	Middle			55
	Low			122
Income	Less than Rs. 15,000			0
	Rs. 15,000 – Rs. 25,000			5
	Rs. 25,001 – Rs. 35,000			71
	Rs. 35,001 – Rs. 45,000			89
	Rs. 45,001 – Rs. 60,000			12
	➢ 60,001			0

According to the analysis, factors that are influencing digital inclusion among disabled community are categorised into five point likert scale. According to the responses given basically categorised the response rates in to 5 categories according to the following method.

Basically total responses valve divided by 5 based on the five point lickert scale. Then it is equally divided into 36, 72,108,140 and grater.

If response rate for a given Factor (F) is less than or equal 36 then points given to this factor is 1. If F greater than 37 or less than or equal 72 then points given to this factor is 2. Then If F greater than 73 or less than or equal 108 points given to this factor is 3. If F greater than 109 or less than or equal 140 points then given to this factor is 4. If F greater than 141 then this factor is assign by 5 point.

Findings are given in the Table 5.

Factor relate to Digital Inclusion	Very important(5)	Imp ortant(4)	50-50 (3)	Less imp ortant(2)	Not imp orta nt(1)
Income(PI)			3		
Education(PE)			3		
Desire for learning(PL)			3		
Entertainment(PE N)			3		
Culture(PC)	5				
web standard issues(TW)				2	
Software incompatibility/us er friendliness (TS)			3		
Cost of Software Technology(OC)					1

Lack of Awareness**(OLA)**					1
Lack of Direction**(OLD)**				2	
Lack of Skills**(OLS)**			3		
Lack of resources**(OLR)**			3		
Lack of Training**(OLT)**	5				

Based on the above finding it is indicated that different factors are affecting in different level.

Overcoming Digital inclusion factors

The second research question is to find out a suitable method to solve the issues. Based on the literature and survey findings, solution framework describe below figure 2.
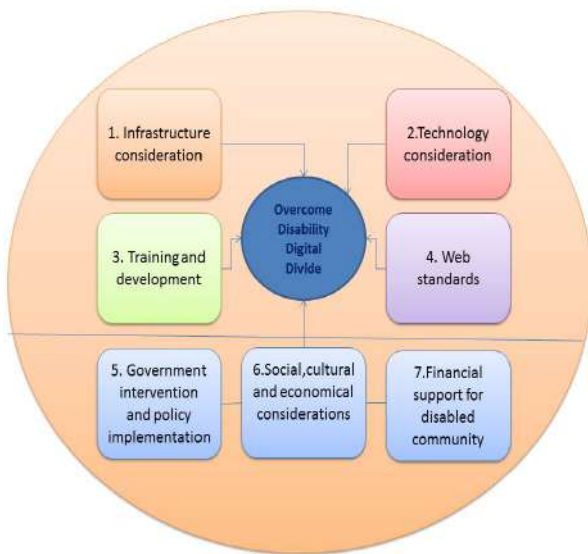

Figure 2: digital inclusion solution framework

1 Infrastructure Consideration

Smart objects connected through radio signals, Bluetooth and wireless connectivity and Internet of Things (IOT) base Solutions. In addition to that one main factor that needs to improve the digital inclusion among the disabled community is the telecommunication infrastructure changers.

When the roads are newly constructed, implementing obstacle detection will help blind people to detect obstacle. Object interconnected and improves the usability. Web base solutions for disabled are need higher bandwidth special on accessing computers and internet. Community centres are far away and difficult to travel for disable people.

2. Technology Consideration

Promote low cost technologies are one main solution to overcome the digital inclusion. Invest to development on low cost solution and promote research and development on low cost technology solutions

Promote Language friendly Applications. Develop and test the language base solutions such as text to voice converter in Sinhala and Tamil language.

Mobile technology considerations are another finding to make disable people incisive on digital technologies. Follow the mobile accessibility guidelines. Design mobile accessibility guidelines (Ex. BBC guidelines for mobile development for disabled)

Computer technology considerations are another main factor. Computer technology considerations divide according to the barriers faced by the disabled community. These barriers can be grouped into three functional categories: barriers to providing computer input, interpreting output, and reading supporting documentation.

3. Training and Development

Special Design IT training for middle age people will be helpful for digital inclusion. Implementing a disabled training module is another solution. Special Design IT training for old people needed to consider. Specific user oriented training for old disable users

4. Web Standards

Promote W3C guide lines among web developers. Identify the problems of current implementations Awareness on the W3Cguidelines

5. Government intervention and policy implementation

Technology barriers. Study the technological requirement of disabled community and identify the policy issues related to technology

6. Social, Cultural and economic consideration

Social and cultural influences directly correlate with digital inclusion. Influencing by Media could be helpful to make disabled people digitally inclusive. In order to socially interaction differently abled people need to be digitally inclusive. Promote social inter connection with relatives, friend and communicate with similar groups via social media

7. Financial support for disabled community

Financial difficulties among the disabled community make them digitally exclusive. Special loan system to buy smart and computer devises and provide special low cost solutions will make them more digitally inclusive.

V. Conclusion and Recommendation

According to the above two surveys conducted for this research, indicated that digital exclusion is an issue in Sri Lankan differently abled community. Therefore, it is recommended a solution framework for policymakers to consider. It is recommended to validate this solution frame work. Recommended validation are given in the following Table 6.

Table 6: Validation framework

Solution to overcome disability digital divide	Validation method

When the roads are newly constructed, implementing obstacle detection will help blind people to detect obstacle. Object interconnected and improve the usability	Study the case studies on different implementations has been done in other countries.
Web base solutions for disabled are need higher bandwidth special on accessing computers and internet. Community centers are far away and difficult to travel for disable people	Conducing a survey to identify the technology adoption between disable people who are accessing high speed bandwidth and not.
Invest to development on low cost solution and promote research and development on low cost technology solutions	Conduct a survey to identify the technology adaption differences between the people who are using low cost technologies and high cost technologies.
Develop and test the language base solutions .Text to voice converter in Sinhala and Tamil language.	Get the feedback of the user satisfaction to prove the factor
Follow the mobile accessibility guidelines Design mobile accessibility guidelines (Eg. BBC guidelines for mobile development for disabled)	Conducting a comparative analysis to identify the effectiveness of the guidelines for disable people. (Pre implementation and post implementation will be validated)
Computer technology considerations divide according to the barriers faced by the disabled community. These barriers can be grouped into three functional categories: barriers to providing computer input, interpreting output, and reading supporting documentation.	Design an assessment evaluation forms to get the user satisfaction of implementations
Implementing a disabled training module	Survey result to identify the user satisfaction of the training and usability
Specific user oriented training for old disable users	Survey result to identify the user satisfaction of the training and usability
Identify the problems of current implementations Awareness on the	Survey on disabled user satisfaction on before and after implementation of W3C standards for a web
W3Cguidelines	site
Study the technological requirement of disabled community and identify the policy issues related to technology	Propose sample policy changers by analysis of other case studies using in other countries.
Influencing by Media	Develop a video's to present the importance of IT for disabled community. Conducting a survey to measure the improvement of usage by the technology after awareness through media
Promote social inter connection with relatives, friend and communicate with similar groups via social media	Create a social media group and observe the connectivity among the disabled community
Special loan system to buy smart and computer devises Special low cost solutions	Survey on financially capable and incapable disabled community usage. Monitor and assess the improvement of the technology adoption after providing financial support

REFERENCES

Crandall, M., Fisher, K. E. (2009). Digital Inclusion: Measuring the Impact of Information and Community Technology. Medford, New Jersey: Information Today, Inc.

Chen, W. (2013). The implications of social capital for the digital divides in America. *The Information Society, 29*, 13–25. doi:10.1080/01972243.2012.739265

Chadwick, D. D., Quinn, S., Fullwood, C., & Chen-Wilson, J. (2015). Public perceptions of the risks and benefits of being online for people with an intellectual disability. 13th Biannual Research Conference of the Nordic Network on Disability Research, Bergen, Norway, 6–8 May, 2015.

Dobransky, K., & Hargittai, E. (2006). The disability divide in internet access and use. Information, Communnication and Society, (Special Issue: Disability, Identity, and Interdependence: ICTs and New Social Forms), 9(3), 313–334.

Helsper, E. (2008) Digital inclusion: an analysis of social disadvantage and the information society. Department for Communities and Local Government, London, UK.

Hoppestad, B. S. (2013). Current perspective regarding adults with intellectual and developmental disabilities accessing computer technology. Disability & Rehabilitation: Assistive Technology, 8(3), 190–194.

Ritchie, H., & Blank, P. (2003). The promise of the Internet for disability: A study of on-line services and web site accessibility at centers for independent living. Behavioral Sciences & the Law, 21(1), 5–26.

Roger G. Noll, Older-Aguilar. D, Rosston G and Richard R. R(Anon), the digital divide: definitions, measurement, and policy   issues   [online] Http://faculty.chicagobooth.edu/austan.goolsbee/teaching/dig div.pdf

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, M. et al. (2010). Intellectual disability: definition, classification, and systems of supports (11th ed). Washington: American Association on Intellectual and Developmental Disabilities

Sen A.(2009) The idea of justice. Cambridge, The Belknap Press of Harvard University Press

Warschauer, M. (2003). Technology and social inclusion: Rethinking the digital divide. Cambridge, MA: MIT Press.