

Bridging the Disability Digital Divide: An Empirical Study on Sri Lanka

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Abstract

Specifically those who are working with different impairments are not having equal opportunities in accessing Information technology and Internet access compare to the non-disabled working population in Sri Lanka. Objective of this study is to propose an educational training model to bridge the disability digital divide in Sri Lanka. Therefore this community can be effectively contribute to the national development and improve the quality of life of the disabled community.

Keywords

Disability Digital Divide, Technology Adoption, Educational Model

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1. Introduction

A. Background to the Study

In Sri Lanka many people have become disabled due to the civil war during the last three decades. This adds a severe disadvantage for the Nation. Due to their disability many employees facing difficulties in using new technologies in their office work creates major impact on modern organizational culture. Rapidly developing technologies which are daily added into office environment. But the main problem is adoption on those tools and technologies are low among the community.

B. Significant and Objective of the research

The differently-abled population in the country has increased due to the 30 years of civil war. Most of them are working in national security forces of the country. Information and communication technology (ICT) infrastructure is also developed as part of the Sri Lankan development strategy focusing on rebuilding the nation after ending humanitarian operations in 2009. However, still differently-abled community

experiences difficulties in use of ICT based services due to various reasons. This is known as the disability digital divide. Taking necessary steps to reduce the disability digital divide will positively impact on national development in the country. This study proposes a framework to develop technology focused model to bridge the disability digital divide in the country aligning with the e-government strategy. The study consists of two phases. The first phase of the study examined the current technology adaption among differently-abled community in Sri Lanka. The second phase examines the three different viewpoints to reduce the disability digital divide such as web, mobile and personnel computer tools. This model focuses on evaluating the factors affecting perception on technology by differently abled community, problems in technological factors and other critical factors relating to disability digital divide. Findings of the first phase of the study indicated that basic level ICT technologies used by the differently-abled community are not satisfactory and also not sufficient for them to involve in the national development process. The second phase of the study indicated that knowledge and use of mobile devices, mainly mobile phones by differently-abled community is higher when compared to

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use of personal computers and accessing Internet.

Main research question of this research is to identifying issues faced by differently abled community which resulted in digital divide and finding the effectiveness of using ICT by differently-abled people. Outcome of the research propose a web, mobile and computer technology training framework to overcome the disability digital divide.

2. Literature Review

A. Definitions

According to the [1] and [2] 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. [3]

According to the Internet world statistics [4] states that there is a divide of access of information in the world.

According to the Roger *et. al.* [5] digital divide Digital divide is the latest evocative term that refers to differences in access to and uses of information technology that are correlated with income, race and ethnicity, gender, age, place of residence, and other measures of socioeconomic 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.

According to the Sen [6] 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.

Disabled community also face some difficulties of access computers, mobiles and Internet due to their disability. It causes for many reasons such as poverty, lack of awareness, language issues, Social and ethical background and lack of Interest.

B. Theory used for this study

In the Innovation - Diffusion theory the status of Digital Divide of a disabled community was specified by means of an Index. This theory is basically used to identify the technology adoption of the differently abled community in Sri Lanka.

Rogers' diffusion of innovations theory is the most

appropriate for investigating the adoption of technology in the disabled community. Much diffusion research involves technological innovations so Rogers [7] usually used the word “technology” and “innovation” as synonyms. According to Rogers, “a technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome”. It is composed of two parts: hardware and software. While hardware is “the tool that embodies the technology in the form of a material or physical object,” software is “the information base for the tool” Since software (as a technological innovation) has a low level of observation and its rate of adoption is quite slow. The model is given in the figure 01

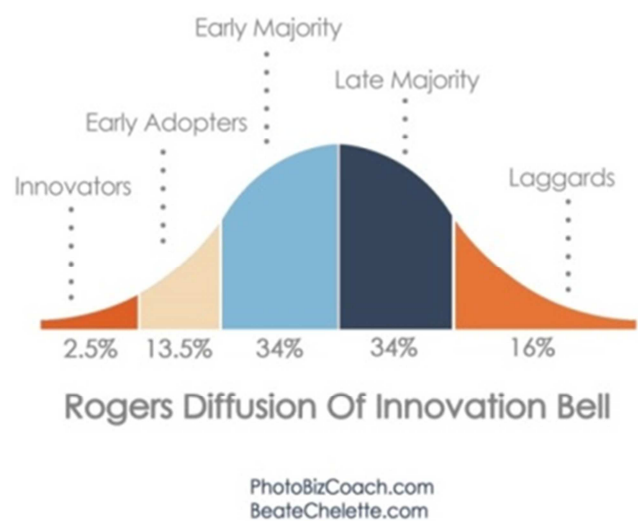


Figure 1. Rogers Diffusion Theory.

3. Methodology and Experimental Design

This study is used to examine the relationship between the level of adoption of ICT in a disabled community, associated factors and the methods used to collect and analyse data are discussed below.

A. Research Strategy

This study has been conducted using an empirical investigation. This research consists of two phases. In the first phase the study on Technology adoption for differently abled community is found using a survey. Second phase included another field survey to find data related to problems and issues related to use of computers, Internet and mobile usage by the disabled community.

B. Data Collection

Data is collected for first phase of this study based on two approaches. The primary data is collected through

observation and interviews done at Sri Lanka Army Light Infantry (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 under different themes of technology accessibility under the

different levels such as basic, intermediate and advance.

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

C. Data Analysis Framework

Table 1. Type of Variable Used for the Empirical Model in Phase 01.

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)

Table 2. Dependent Variables Used in the Empirical Model.

Type of Users	Dependent Variable	Range of the Digital Divide Index
1. ICT Innovators	DDI1	0.8 < DDI > 1.0
2. Early ICT Adopters	DDI2	0.6 < DDI > 0.8
3. Early Majority ICT Adopters	DDI3	DDI3 0.4 < DDI > 0.6
4. Late Majority ICT Adopters	DDI4	DDI4 0.2 < DDI > 0.4
5. Laggards in Adopting ICT	DDI5	DDI5 0.0 < DDI > 0.2

Level of Adoption of Basic ICT (B Basic ICT Facilities ICT) = Basic ICT Facilities/ 3

Level of Adoption of Intermediate ICT (I Intermediate ICT Facilities ICT) = Intermediate ICT Facilities/ 4

Level of Adoption of Advanced ICT (A Advanced ICT Facilities ICT) = Advance ICT Facilities/ 3

In the first sample set differently abled community adopts 2 out of 3 ICT facilities listed under the Basic category, its BICT would be 2/3 = 0.66. Similarly, if the same set adopts 2 Intermediate and 1 Advanced ICT facility, its IICT and AICT would be 2/4 = ½ = 0.5 and 1/3 = 0.33, respectively.

Phase 02

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.

Dependent variable used for this study based on the literature analysis and factors identified by the authors during in their research. Following variables Identified as causes for disability digital divide. It is given in the Table 3, Table 4 and Table 5.

In order to identify the factors affecting to disability digital divide 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. Finally it considers how the person culture effects to disability digital divide.

Technical problems and issues were taken into consideration in the second theme. Basically it discusses web standard issues and software incompatibility or the friendliness.

Next it explains the technical problems and issues. Under this it discusses web standards issues and software incompatibility or the friendliness.

Thereafter it concerns the other inhibiting factors such as cost of software technology and use of it. Awareness of the technology, Use only some basic technologies without proper direction. Though some people have proper direction but due to disability they have some 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 used.

The above factors are summarised in the Table 03 as a summary.

Table 3. Factors to consider in the framework.

Perception on Technology (Independent Variables)	Technical problems and issues (Independent Variables)	Other inhibiting factors (Independent Variables)
Income(CPI)	web standard issues(CTW)	Cost of Software Technology(COC)
Education(CPE)	Software incompatibility/user friendliness (CTS)	Lack of Awareness(COLA)
Desire for learning(CPL)		Lack of Direction(COLD)
Entertainment(CPEN)		Lack of Skills(COLS)
Culture(CPC)		Lack of resources(COLR)
		Lac of Training(COLT)

The above discussed factors are common when use of mobile, web/ Internet or computers. Therefore these factors were separately analyses with different technologies. In the table 04 the above factors were concern when using web

technologies. Questioner were separately analysis the below factors separately analysis the below factors in order to identify the disability digital divide.

Table 4. Web related factors.

Perception on Technology (Independent Variables)	Technical problems and issues (Independent Variables)	Other inhibiting factors (Independent Variables)
Income(WPI)	web standard issues(WTW)	Cost of Software Technology(WOC)
Education(WPE)	Software incompatibility/ friendliness(WTS)	Lack of Awareness(WOLA)
Desire for learning(WPL)		Lack of Direction(WOLD)
Entertainment(WPEN)		Lack of Skills (WOLS)
Culture(WPC)		Lack of resources(WOLR)
		Lac of Training (WOLT)

The questionnaires were further analyses the above factors discussed in the table 03. When they using mobile technologies same consideration were further analyses which related to the mobile technology which is shown in the Table

05. Same factors also consider, finding the adoption for the computer usage.

Table 5. Mobile related factors.

Perception on Technology (Independent Variables)	Technical problems and issues (Independent Variables)	Other inhibiting factors (Independent Variables)
Income(MPI)	web standard issues(MTW)	Cost of Software Technology(MOC)
Education(MPE)	Software incompatibility/user friendliness(MTS)	Lack of Awareness(MOLA)
Desire for learning(MPL)		Lack of Direction(MOLD)
Entertainment(MPEN)		Lack of Skills(MOLS)
Culture(MPC)		Lack of resources(MOLR)
		Lac of Training(MOLT)

4. Presentation of Findings

Descriptive statistics of the sample, the general information of differently abled community (age, experience in technology), and the other details are reported in Table 4.

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 between 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 percent of the participant had English language issues and they are working in Sinhala language. As a result 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 new 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 to 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.

Table 6. Use of Technology.

Variable	Description	Respondent	Percentage
B1	Telephone Use	252	98 %
B2	Web Access	150	58 %
B3	Computer Use	155	60 %
I1	Office application Use	131	51 %
I2	Multimedia use	28	11 %
I3	Screen reader Software use	4	0 %
I4	Social media use	10	0 %
A1	IT Administration	2	0 %
A2	S/W Design Development related	1	0 %
A3	High-tech S/W Use	0	0 %

Level of Adoption

According to the Rodgers adoption theory discussed above following calculations were done to identify the level of adoption.

Level of Adoption of Basic ICT (B Basic ICT Facilities ICT) = Basic ICT Facilities/ 3

According to the formula values for adoption in basic ICT is 72 % .Therefore this study conclude that level of adoption among the use of basic ICT Facilities are between 0.8 and 0.6. Therefore it is proved that this community are early users for basic level of ICT facilities. This is shown in the Figure 2.

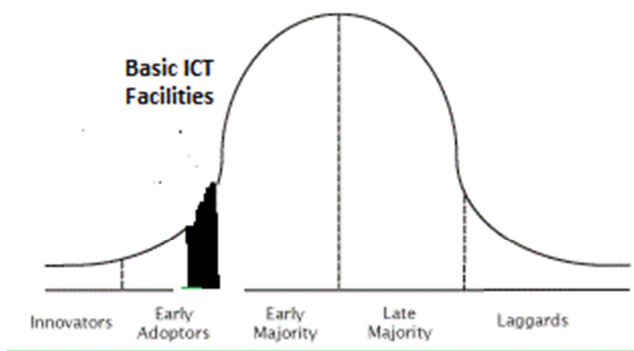


Figure 2. Adoption on Basic ICT Facilities.

Level of Adoption of Intermediate ICT (I Intermediate ICT Facilities ICT) = Intermediate ICT Facilities/ 4

According to the formula, values for adoption in Intermediate ICT is 15.5% .Therefore this study concludes that level of adoption among the users of basic ICT Facilities are between 0.2 to 0.0. Therefore it proves that this community is Laggards in Adopting ICT for Intermediate level of ICT facilities. This is shown in the Figure 3.

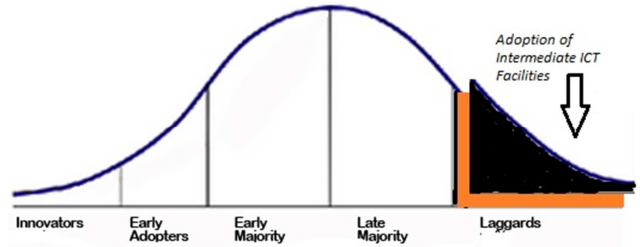


Figure 3. Adoption of Intermediate ICT Facilities.

Level of Adoption of Advanced ICT (A Advanced ICT Facilities ICT) = Advance ICT Facilities/ 3

According to the formula values for adoption in advance ICT is 0 % .Therefore this study concludes that level of adoption among the use of basic ICT Facilities is between 0.2 to 0.0. Therefore, it is clear that this community is Laggards in Adopting for advance ICT facilities. This is shown in the figure 5.

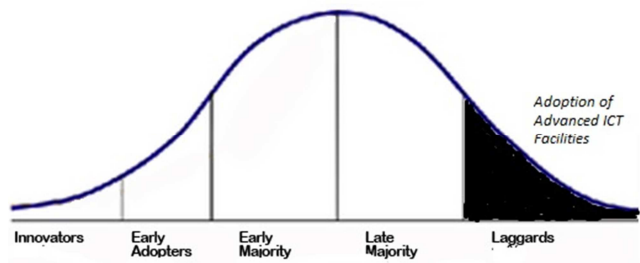


Figure 4. Adoption on Advance ICT Facilities.

According to the analysis, 58 % are using web services including E-mail system, but it is noticeable that the usage of Social media is 0%. Reason for this deviation is that this community does not have social relationships with the use of high technology.

Mobile, Web and Computer Adoption- Phase II

In the phase II of 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 no of people with different complications of disabilities were involved. All together 177 no of participants were taken in to this research.

According to the phase II study findings it was indicated that among the three technologies mobile usage is high among the community and computers and web usage is not much popular among them. The following figures 6, 7 and 8 have shown about the technology adoption.

Similarly in the Phase 01, Phase 02 also analysis done to find the adoption of the different technologies such as mobile, web and computer. Out of 177 sample 78 % of them are using mobile technologies. Therefore according to the technology adoption curve it is come under the range

between 0.6 to 0.8 ranges. Then it concludes as these disabled users are early adopters when using mobile technology.

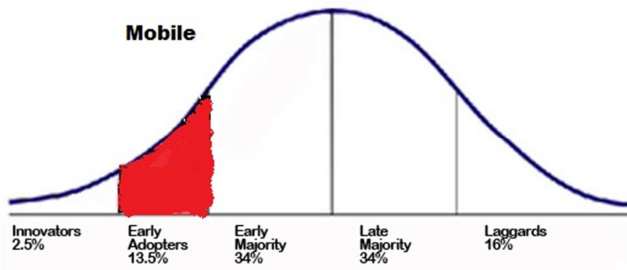


Figure 5. Mobile Technology Adoption.

Out of 177 sample 16 % of them are using mobile technologies. Therefore according to the technology adoption curve it is come under the range between 0.6 to 0.8 ranges. Then it concludes as these disabled users are laggards when using web.

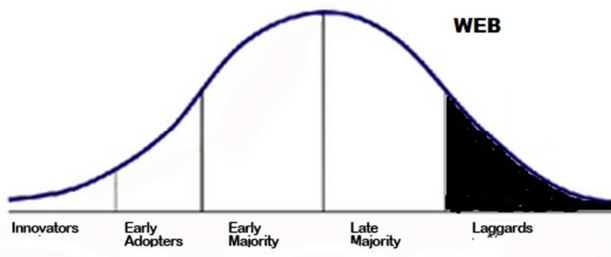


Figure 6. Web Technology Adoption.

Out of 177 sample 19 % of them are using computer technologies. Therefore according to the technology adoption curve it is come under the range between 0.0 to 0.2 ranges. Then it concludes disabled users are laggards when using computer technology.

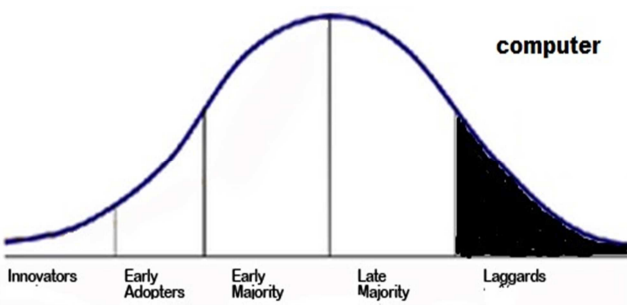


Figure 7. Computer Technology Adoption.

5. Result

Factors contributing to the for digital divide according to the literature survey result [9], [10], [11], [12], [13], [14] and many researchers indicated that globally many reasons caused the digital divide.

According to the above phase I and phase II findings indicate that technology adoption on different technologies and different facilities are distributed in the normal bell shape curve. Therefore overcome the digital divide issues among the disabled community need to consider in multiple perspectives.

To overcome the disability digital divide propose a model for implementation on training on the three different technologies discuss in this paper. Propose model discussed in the three dimensional technology training and benchmarking to access the model.

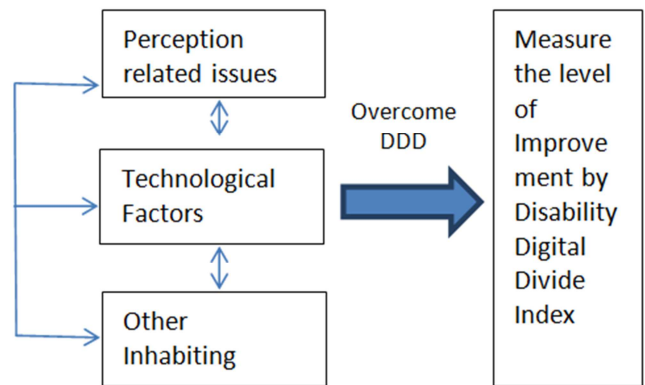


Figure 8. Framework to overcome Disability digital divide.

To overcome the issues identified solutions were recommended through this framework. This solution were covered the three different technologies such and mobile web and computers related factors.

A. Changing Perception on IT

Under this indicator five different variables were considered to measure the disability digital divide.

Low Income - Proposed solution for this issue is to give a Special allowance or loan system to purchase or lease mobiles, Computers, and assistive tools and technologies.

Promote special low cost packagers for disabled community. In order to measure the effects to overcome the disability digital divide policy makers could Cross check the level of improvement in use of Mobile, computer and web.

Education – Overcome this issues it is recommended introducing a special education programme for awareness on computing, new features and applications in the smart mobile phones and Internet. These educations modules could be promoted in three different levels such as trainings on basic levels, Intermediate levels and advanced level trainings. In order to measure the effects to overcome the disability digital divide policy makers could Cross check the level of Knowledge by introducing a skill test and certify them and give recognition to them. This will helpful them to use for their promotions and may be find a new job.

Desire in Learning - This community need to motivate them by promote awareness program among the low technology adopters in different technologies. Most effective way to overcome the digital divide is to promote programs related to their current or future carrier. Again after awareness through a survey can measure the level of likeness to have training on different technologies.

Entrainment - Many of this community is disadvantage of accessing current entertainment available in mobile, computers and internet. By promote to use this new entertainment methods will directly reduce the disability digital divide in the country. This could be measured by no of disables user's improvement of using entertainment such as music, watching or listening tele-dramas, music programs or any other popular programs via web, mobile or computers. In addition to that Improvements of using computer .mobile or internet games also could be measure to find the disability digital divide.

Culture - In this culture of the disabled people and the technology ideas, customs and social behavior developers are considered. Therefore remove the disability digital divide can introducing by, testing with assistive technologies, get feedback from people with disabilities and those who are support for their day today activities.

B. Removal of other Inhibiting factors

Web standard issues - This could be removed by Add alternative text to images, Consider Captioning for Audio and video, Transcription facilities for brail and other devises, Follow latest release on w3c ,by following WAI accessibility guidelines for mobile accessibility and other web developments. Effects of digital disability divide can be measure by implement policies for disabled in national level for web and mobile developments.

Software incompatibility/user friendliness -

Overcome the Issues with this software incompatibilities need be consider to eliminate the disability digital divide in the country. When software is designed to run mobile applications or a normal standalone machine or as a web page in the www, all functionalities need to be executable in a keyboard. Accessibility features need to be developed and documentation is a requirement. The meaning assign to images need to be meaningful to convert in the screen readers. Colour selection for the systems is necessary to consider about colour blindness issues. Non Animation presentation mode is necessary to include in any mode. Software need to avoid or using blinking text or any flash or blink frequency greater than 2 Hz and lower than 55 Hz. The above identified each problems could be identified and use a benchmark to release the software and feedback will be helpful to remove

the disability digital divide issues in the field.

C. Removing other inhabiting factors

Lack of Awareness- To overcome this issue different awareness programme on the new mobile technologies, computer programs and use of Internet propose to conduct. This program need to classify in to three different levels such as basic, Intermediate and advanced tools and technologies. After awareness improvement of use of technology can be measure to find the outcome of disability digital divide

Lack of Directions - This factor consider on the proper directions to use web, mobile and computer for their job related activities. This could be implemented by identifying different technological requirement necessary for their job. Most of the digital divide barriers could be overcome by implementation this training. Usability testing will be measure to find the co-relationship of this factors and disability digital divide.

Lack of Skills and training -

Different destabilise are having different problems and issues and they need with different skills and training requirements to overcome the disability digital divide. For an example training for mobile use for blind is differ for person with hearing problems. Therefore Individual training is required per person along with their disability. Performance could be measure to find the influence of digital divide by individual base.

Lack of resources -

Resource canters with special equipped assistive technologies could be used to overcome different digital divide issues. People with having vision issues could be equipped with refreshable brail system, equipment used to different disabilities will be more effective. Specifically for people with having partially impaired vision could be equipped with refreshable braille system, Screen magnifier, etc. Overall performance could be measure by use and adoption of technology after used this technologies.

6. Conclusions

The objective of this research is to propose an educational framework to overcome the disability digital divide. Results were indicated the current Sri Lankan technology adoption according to different technologies with including web, mobile and computer related technologies. It is recommended to implement different strategies to overcome the disability digital divide while removing the barriers related to perception on technologies, technological issues and other inhibiting factors on web, mobile and computer.

Acknowledgment

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