

Towards a Model for User Technology Readiness in ICT4D Initiative

Research in Progress

K. K Supriya (Doctoral Student)
Information Systems Area
Indian Institute of Management, Kozhikode
Email: supriyakk04fpm@iimk.ac.in

M.P Sebastian (Professor)
Indian Institute of Management, Kozhikode
Email: sebasmp@iimk.ac.in

Krishnadas Nanath (Professor)
Middlesex University, Dubai
Email: username.krishna@gmail.com

Abstract

Information and Communication Technologies (ICT) are fuelling the growth of global economy and intelligent use of ICT is a key to transform societies. ICT is widely used in today's economies to solve a wide variety of social and economic problems. The main factor which determines the success of a high technology project in a social setting is its acceptance and usage rate, and user technology readiness is the main determinant of use intention. The study tries to explore the various factors which affect the end user technology readiness in an ICT4D context. ICT4D is defined as the design and use of ICT and E-services that consider social context and socio-economic development. An empirical analysis will be done to identify the relationships and a case study on an implemented project will be carried out to validate the model in a real setting.

Keywords

ICT for Development, Technology Adoption, Technology Readiness, E-governance Readiness.

INTRODUCTION

It is widely presumed that universal access to ICT (Information and Communication Technology) would bring about a global community of interaction, commerce and learning resulting in higher standards of living and improved social welfare (Dewan 2005). ICTs present before the society a huge potential for social and economic development; especially in the context of developing countries. The past decade has witnessed increased importance given to ICT for achieving a variety of development objectives, including poverty alleviation, extension of health services, expansion of educational opportunities and access to government services.

ICT for Development (ICT4D) is one of the main themes in Social Informatics studies, which is a part of the larger body of socio-economic research that examines the ways in which the technological artifact and human social context mutually constitute the ICT ensemble (Kling 2000). In the study, we define ICT4D as design, implementation and use of ICT and E-services that consider social context and socio-economic development. ICT is simply a tool which supports the ICT4D activities. Beyond this, there is an enabling environment, which comprises the society, government and non-governmental agencies, culture, policies, technology features, etc. which accept and institutionalize these initiatives (Tigre 2003; Molla 2005) and contribute to the successful implementation of any massive scale technology project. A study conducted by Huarng (2011) to measure the comparative ICT developments by economies revealed that the ICT development indices for developing countries remain consistently low over a long period of time. A number of factors are attributed to this poor development which include poor infrastructure, low internet penetration rate and low literacy rate. There is a need to investigate the issues in the use of ICT for developing economies and societies, where the constraints limit the use of ICT compared to the highly developed economies.

Access to technology and usage are the main factors which affect the success of a high technology project (Porter and Dantu 2006) in a social setting and user technology readiness is the main determinant of the usage rate. Low ICT development index poses a serious threat to the sustainability of ICT4D initiatives. In spite of improved efforts from the side of the government, user participation in the E-services and user readiness rankings are going down in many developing countries (UN E-governance Report 2012). The technology

readiness and acceptance model (TRAM) theorizes that user technology readiness is the main determinant of use intention (Lin 2007). Technology readiness refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work (Parasuraman 2000). Extant literature, practitioner interviews and secondary data analysis using technology readiness indices indicate that participation of Indian citizens in the E-services is relatively low compared to the developed counterparts. The analysis also revealed that user technology readiness rankings for ICT4D in India had declined over the period from 2003 to 2012. Therefore, it is worth investigating why the user feels uncomfortable in using the technology enabled services in a real life setting and how the present scenario can be improved.

The lack of user participation in ICT4D initiatives and reluctant usage of its services led to the research questions addressed in this study. The main objective of the study is to explore the perceived end user technology readiness for an ICT4D project. The proposed study seeks to obtain desirable research outcomes by adopting a mixed method approach that employs both quantitative and qualitative research methodologies. It identifies the various factors that affect the end user technology readiness for an ICT4D project. The extant literature on technology acceptance and consumer readiness and UN E-governance reports were analysed to derive the factors that contribute to technology readiness. After a brief literature review on ICT4D domain and technology readiness research, this paper presents technology readiness and consumer participation indices trend over many years. The research questions are formulated and the subsequent theoretical background which is followed by the conceptual model and hypotheses development. The paper concludes highlighting the significance of the study.

ICT4D LITERATURE REVIEW

ICT for individual and group development were identified as emerging areas of research in the study conducted by (Sidorava 2008). ICT4D which is also known as 'Development Informatics', was an active research area, especially in the last five years. However, there is a shift in focus of the issues examined from time to time. Heeks (2008) classified ICT4D research into three phases.

Phase 1: ICT4D 0.0 (Existed from mid-1950s to late-1990s)- This was before the creation of the term "ICT4D". The focus was on broadcasting development communication, and computing / data processing for back-office applications in large government and private sector organizations in developing countries.

Phase 2: ICT4D 1.0 (late-1990s to late-2000s)- The special emphasis given to ICT4D in Millennium Development Goals and mainstream usage of the Internet in industrialized countries inspired a rapid rise in investment in ICT infrastructure and ICT projects in developing countries. A very common application was the telecentre which maintains information on development issues such as health, education, and agricultural extension to under developed communities. Telecentres also deliver online or partly online government services.

Phase 3: ICT4D 2.0 (late-2000s onwards)- This phase marks the change in technology from the telecentre to the mobile phone as the archetypal application. This has more focus on the poor as producers and innovators with ICTs (as opposed to being consumers of ICT-based information).

The research trends and number of articles published in the ICT4D domain are shown in Figure 1 and Figure 2, respectively. The literature has examined the consequences and hindrances of deploying ICT (Mamaghani 2010). ICT4D projects used to have multiple stakeholders leading to a complex ecosystem. The main research fields under the ICT4D domain include ICT for education, healthcare information system (HIS), ICT for agriculture and poverty reduction, E-governance, and digital divide. The main issues in each of the above domains are presented in Figure 2.

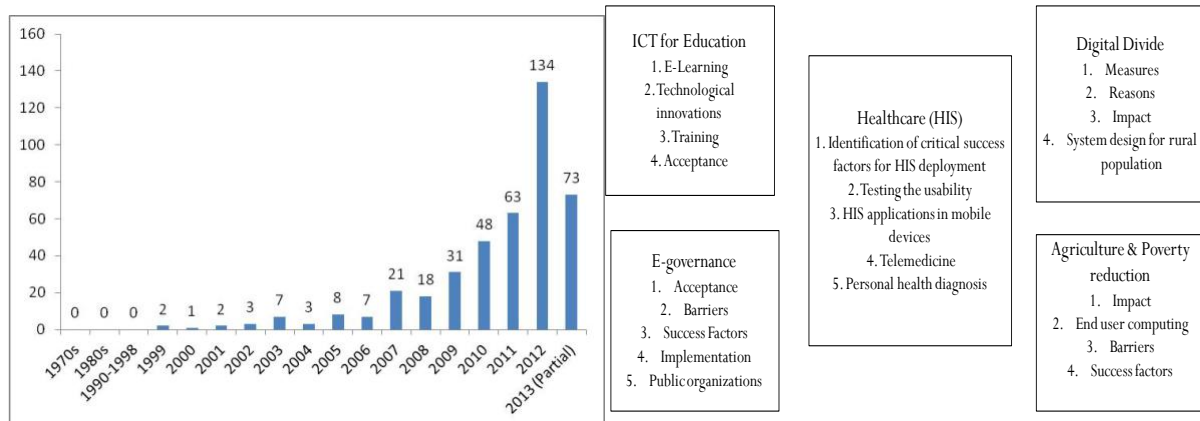


Figure 1: ICT4D Research Timeline

Figure 2: Research Focus

The following gaps identified from the literature survey need more attention: (i) The impact of ICT4D projects on the society. (ii) Reach of these initiatives to the under privileged and poor (iii) Consumer Technology Readiness. (iv) Sustainability of ICT4D projects (v) Scalability (vi) ICT4D implementation issues in the developing countries as the project failure rates are very high in those regions when compared to their developed counterparts. In this study, a preliminary analysis on the secondary data was used to understand the consumer involvement issues in the ICT4D field. Consumer technology readiness and sustainability of ICT4D initiatives in Indian context are the main focus of the study here. The technology readiness literature is reviewed to identify the factors that contribute to it.

Technology Readiness Literature

UN governance reports were analysed to find the technology readiness and consumer participation indices trend over many years. Table 1 presents the E-participation trend for India and Table 2 shows the technology usage readiness ranking for India. These two rankings are based on the scores of E-participation index and usage readiness index respectively. It ranks the member countries of UN on the basis of their score on the two dimensions. UN E-governance reports (2003 to 2012) indicate that the Indian citizen E-service participation rankings are generally less than the average rankings. With the increase in number of E-services provided by the government, the corresponding increase in the consumer usage rate is low. The readiness ranking measures the degree to which a society is prepared to make good use of an affordable ICT infrastructure and digital content. When we compare the usage readiness ranking for individuals with government and business firms, we can see that the individual usage readiness is far below than the other stakeholders in the ICT4D ecosystem and the skill ranking is also low. The most worrisome aspects are the mediocre quality of the political, regulatory, and business environment, as well as its lack of digital infrastructure (The Global Information Technology Report, 2013).

Table 1: E-participation Index

Year	E-participation Index	Rank
2003	0.259	41
2004	0.1311	59
2005	0.1587	34
2008	0.25	49
2010	0.2	55
2012	0.184	71

Table 2: Technology Readiness Ranking 2013

Individual Usage	Business Usage	Govt Usage	Affordabil ity	Skill
121	45	40	1	100

Interviews with the state E-governance project manager and various other ICT4D project coordinators also reveal that the common man is reluctant to use the ICT services being provided to them by the government. Lack of technology awareness and resistance to change are the main issues faced by the users. People tend to follow the conventional paper based method of getting the services even if they can avail it through service centres which are handled by trained people. The main issue portrayed from both the secondary data and interviews here is that the common citizen is not comfortable using the technology enabled services and they lack the skills to do so. The study tries to explore the various factors that affect the end user technology readiness in case of an ICT4D project and its influence on use intentions.

Technology readiness (TR) construct was first defined by (Parasuraman 2000). The TR conceptualizes consumers' general beliefs about the technology and is associated with their use of technology based products and services. TR refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work. It is a combination of mental enablers and inhibitors that collectively determine the

predisposition to use new technologies. Technology readiness influences the intention to use a particular technology and consumers' TR has a positive influence on their online service quality perceptions and online behaviors, but empirical findings are scarce (Zeithaml 2002). The famous TRAM (Technology Readiness and Acceptance Model) model argues that TR impacts the use intention, which is mediated through perceived ease of use and perceived usefulness (Lin 2007). The important aspect here is that TR is not project specific but individual specific, and this makes it suitable to study people oriented initiatives like ICT4D.

The main difference between TRAM and Technology Acceptance Model (TAM) is that, TAM was originally developed to predict technology adoption behavior in work settings. Non work settings are different from work settings because they are not restricted by the organizational objective. TAM fails to explain technology adoption in non work settings. In a personal setting, high involvement of customer is necessary to co produce the service (Lin 2007) and there is a need to explore the applicability of TAM in social settings. Most of the studies use TR as a formative variable. In this study, TR is specified as a reflective variable which captures the user's willingness and comfort in accepting a new technology.

Research Questions: The main research questions in this study are:

1. What are the factors that motivate users to try new technologies?
2. What are the factors that contribute to consumer technology readiness in ICT4D initiatives and how does technology readiness impacts the use intentions?

Another objective of the study is to test the applicability of TRAM and TAM in ICT4D Context.

THEORETICAL BACKGROUND AND CONCEPTUAL MODEL

The study draws upon the theories of technology acceptance model, diffusion of innovation theory, social cognitive theory and the extant literature on consumer readiness to derive factors that contribute to technology readiness. The objective here is to identify the factors that can possibly influence the consumer's willingness to accept a new technology. In a complex social setting, a lot of cultural, political, technical, legal and governmental factors can influence consumer's willingness and attitude towards using those particular technologies. The literature on technology adoption and consumer readiness was reviewed to identify the suitable theories for the context of the study.

Diffusion of Innovation Theory (Rogers, 2010): DOI is a general theory of how new ideas are spread and adopted in a community, and it seeks to explain how communication channels and opinion leaders shape adoption. Moore and Benbasat (1991, 1992) used DOI to develop an instrument designed to measure the various perceptions that an individual may have of adopting an information technology (IT) innovation. It was consistently found that technical compatibility, technical complexity, and relative advantage (perceived need) are important antecedents to the adoption of innovations (Bradford and Florin 2003). Meuter et al. (2000) have used some of these factors to study the consumer readiness in adoption of self service technologies. Here we propose that ICT4D complexity, relative advantage and compatibility affect the user technology readiness in ICT4D context. The rationale for selecting the variable relationship is shown Table 3.

Social Cognitive Theory: The social cognitive theory explains how people acquire and maintain certain behavioural patterns (Bandura 2001). Evaluating behavioral change depends on the factors environment, people and behavior. SCT provides a framework for designing, implementing and evaluating programs. Environment refers to the factors that can affect a person's behavior. There are social and physical environments. (Compeau et al., 1999) developed a model, based on Bandura's Social Cognitive Theory to test the influence of computer self-efficacy, outcome expectations, affect, and anxiety on computer usage.

Factors Derived: Resistance to Change (Grembler 1995), Technology Anxiety (Raub 1981), Need for Interaction (Dabholkar, 1986), Previous Experience (Meuter 2000). Other factors related to individual characteristics are computer self efficacy and social influence. Variable details and hypotheses justification are shown in Table 3.

TOE Framework: The process by which the adoption and implementation of technological innovations is influenced by the technological context, the organizational context, and the environmental context (Tornatzky and Fleisher 1990). The theory is used to derive some of the specific factors including, Service Quality (Liljander, 2006), IT Strategic Readiness (Koh et al., 2006), Management Support (Swink 2000), and Educational Programs (Meuter 2000).

Other factors identified from the consumer readiness literature are trust in government, computing support and access barriers. In online service dynamics, users trust in the service provider positively influences consumer

willingness to transact online (Ribbink and Liljander 2004). The extent to which the user believes adequate computing support been given in the use of the system creates willingness to try the technology (Moore, 2012). Presence of computing support was also found to increase satisfaction in using the technology (Walczuch and Lemmink 2007). Perceived access barriers were found to have an impact on attitudes towards Internet usage (Porter and Donthu 2006). Perceived lack of infrastructure access is a reason why people are hesitant to use HIS and e learning technologies (Skinner and Biscope 2003).

THE CONCEPTUAL MODEL AND HYPOTHESES

Factors are grouped into four main domains such as innovation characteristics, macro environment characteristics, user characteristics and ICT4D project specific characteristics. Figure 3 presents the conceptual model of the study. The model specifies 17 main effect hypotheses and moderating relationships. Consistent with UTAUT model (Venkatesh et al., 2003) and the literature on technology acceptance and consumer readiness, the study suggests that age and gender moderates the relationship between TR and the project specific, technology specific and user specific characteristics. The main effect hypotheses are listed in Table 3. According to Technology Readiness and Acceptance Model (Lin 2007), the perceived usefulness and perceived ease of use mediates the relationship between technology readiness use intentions. The study proposes that the external variables directly impact the user technology readiness and this in turn influences the use intentions.

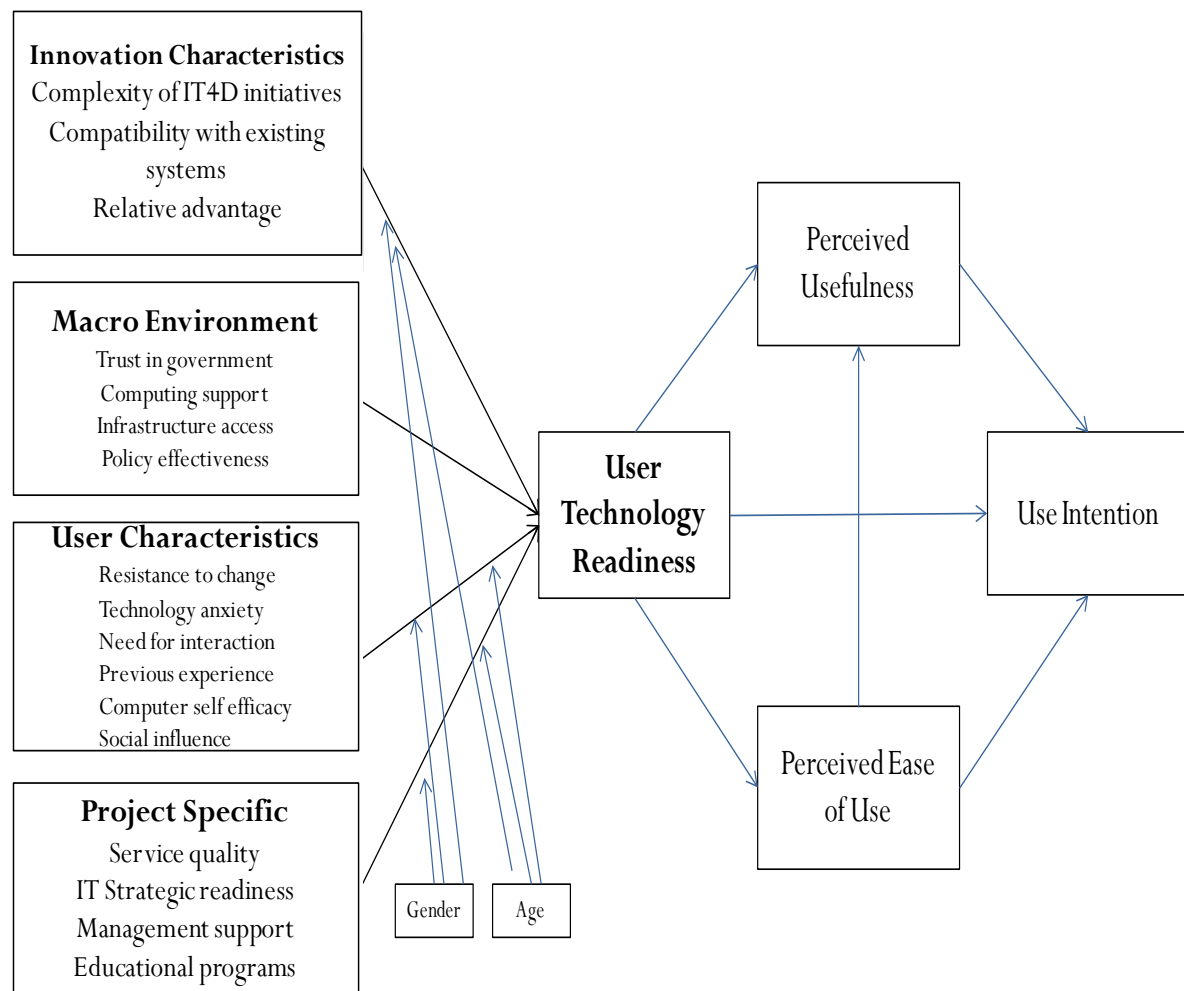


Figure 3: Consumer Technology Readiness Model

Table 3: Hypotheses Justification

No.	Hypothesis	Rationale
H1	High perceived complexity of ICT4D project leads to low user technology readiness.	A complicated, confusing technology will hinder clarity because it will be more difficult to operate and understand and may also make the benefits (motivation) less apparent to the user (Liljander 2005).
H2	High perceived compatibility with existing system leads to high technology readiness of user.	Compatibility will increase readiness because ICT4D activities will be consistent with values and lifestyle and thus influence the willingness (Eastlick 1996; Gatignon 1991).
H3	High perceived relative advantage of ICT4D leads to high technology readiness of user.	Relative advantage will encourage customers to learn about technology. The advantages also provide a motivational force by providing incentives (Eastlick 1996; Meuter 2000).
H4	High resistance to change leads to low user technology readiness.	Inertia may limit efforts to learn about technology. Using a new Technology also requires an investment in time and energy, thus reducing motivation (Gremmler 1995; Olshaysky and Spreng 1996).
H5	High technology anxiety leads to low user technology readiness.	Technology anxiety may lead to anxiety and confusion regarding the task to be performed (Meuter and Bitner 2005; Parasuraman 2000).
H6	High need for interaction with supporting staff leads to low user technology readiness.	A high need for personal interaction may lead to decreased interest in learning how ICT4D work and reduced motivation to try it (Dabholkar 1996; Langeard et al. 1981).
H7	Good previous experience leads to high user technology readiness.	The previous use of related technology will increase perceptions of self-confidence and ability (Bowen, 1989; Gardner, Dukes, and Disenza 1993).
H8	High computer self efficacy leads to high user technology readiness.	Self efficacy leads to increased confidence and motivation to try a new technology and experience a stronger control over the technology (Hill, Smith, and Mann 1987) (Chu 2009).

H9	Social influence is positively associated with consumer technology readiness.	The social influence processes determine the individual user's commitment, or more specifically, psychological attachment, to the use of any new information technology (Malhotra 1999; O'Reilly and Chatman 1986).
H10	Trust in service provider leads to high user technology readiness.	In online service dynamics, users trust in the service provider positively influences consumer willingness to transact online (Ribbink and Liljander 2004).
H11	Presence of computing support increases the user technology readiness.	The extent to which the user believes adequate computing support been given in the use of the system creates willingness to try the technology (Moore 2012). Presence of computing support was also found to increase satisfaction in using the technology (Walczuch and Lemmink 2007).
H12	Access barriers negatively influence the user technology readiness.	Perceived access barriers were found to have an impact on attitudes towards Internet usage (Porter and Donthu 2006). Perceived lack of infrastructure access is a reason why people are hesitant to use HIS and E-learning technologies (Skinner and Biscope 2003).
H13	Policy effectiveness positively influences technology readiness in consumers	Inefficient policy is a main barrier in most of the ICT4D initiatives. Presence of effective policies gives trust in the user and in turn impacts the technology readiness (Jho 2005).
H14	High service quality positively impacts the technology readiness.	Service quality was found to be having a strong impact on consumer's willingness to try e commerce and online shopping (Lee 2005; Cox 2001).
H15	High IT Strategic readiness leads to high consumer technology readiness.	Strategic planning for the internet, business objectives of the internet, integration of the internet with business objectives and alignment of the internet and business strategy helps in creating a positive attitude towards using E-governance (Koh 2006).
H16	High top management support leads to high technology readiness.	Adequate resources, sufficient funding, and technical expertise of the management makes the users comfortable in using a new technology and increases their confidence level (Swink 2000).
H17	Educational programs	Presence of educational programs and awareness campaigns urges the consumer to try a new product/technology (Nijssen 1995).

METHODOLOGY

The proposed study seeks to obtain desirable research outcomes by adopting a mixed method approach that employs both quantitative and qualitative research methodologies. A Self administered Survey will be used to collect the data from end users. Sampling will be done based on Dataquest survey results. The Dataquest-Cyber Media Research E-readiness Assessment of Indian States 2013 revealed that Delhi, Kerala, Goa, Gujarat and Andhra Pradesh had topped the rankings in the overall planning, implementation and outcomes generated from their IT policy initiatives, administrative reforms and roll-out of E-governance programmes. Users' from any of the top 3 states will be asked to fill the survey. Only those people who had used at least one of the ICT4D initiatives (from the list of services given in the government website) in the past three years will be asked to fill the survey.

The scales will be subjected to pre-test with 50 users, and will be examined for the descriptive statistics, item-to-total correlation and cronbach alpha. Items with weak item-to-total correlation will be eliminated or modified prior to final data collection. The collected data will be used to test the hypothesized relationships in the conceptual model. We plan to use both structural equation modelling (SEM) and moderated multiple regression to analyse data and test the hypotheses. A case study on a successful and failed ICT4D projects will be carried out after the empirical analysis to see whether the model holds in a real setting. It will be analysed to see whether the user technology readiness was high in the successful projects and how the different factors contributed to TR as compared to the project that had failed

CONCLUSION

Extant literature, practitioner interviews and secondary data analysis using technology readiness indices indicated that participation of Indian citizens in the E-services is relatively low when compared to its counterparts in the developed world. The analysis also revealed that user technology readiness rankings for ICT4D in India had declined over the period from 2003 to 2012. Interviews with the E-governance project managers and various other ICT4D project coordinators also revealed that the common man is reluctant to use the ICT services being provided to them by the government. Lack of technology awareness and resistance to change are the main issues faced by the users. People tend to follow the conventional paper based method of getting the services even if they can avail it through service centres which are handled by trained people. The main issue portrayed from both the secondary data and interviews here is that the common citizen is not comfortable using the technology enabled services and they lack the skills to do so. The case study analysis also implied that lack of awareness and insufficient training programs are the main factors attributing to these issues.

In a social setting where the use intentions are not directed by any organizational objectives, the consumer's willingness to try a new technology depends on a set of other environmental parameters. People are not aware of the benefits associated with using technology enabled services. Interviews portrayed that majority of the consumers find political and cultural issues affecting their willingness to use a new technology. In consistent with the exploratory interview results, this study expects that the empirical analysis will also show that factors listed in the macro environment and project specific dimensions will have a high influence on the technology readiness compared to the other two.

The study focused on the end user technology readiness aspect of the ICT4D initiatives and not technology acceptance. It argued that technology readiness is the determinant of use intentions, which in turn is, determined by the external variables. The following are the expected contributions from the study. (1) It advances the theory of technology acceptance by developing a novel framework for technology readiness and examines its relationship with technology acceptance in a social setting. (2) It gives practitioners new insights on how to implement the ICT4D initiatives successfully by working on parameters of technology readiness. The case studies on successful and failed projects have given a picture on how TR determines the sustainability of the projects. A comparison between the two helped in building a framework for successful implementation of ICT4D activities. Testing the applicability of TAM in social context is one of the aspects of the study.

As a part of the future study, we propose to test the hypotheses empirically and then validate the model qualitatively in a real life setting. A Self administered Survey will be used to collect the data from end users. Only those people who had used at least one of the ICT4D initiatives (from the list of services given in the government website) in the past three years will be asked to fill the survey. The collected data will be used to test the hypothesized relationships in the conceptual model. We plan to use both structural equation modelling (SEM) and moderated multiple regression to analyse data and test the hypotheses. The second part of the study will focus on building a case study on a successful and failed project to see how consumer technology readiness in reality

affects the success of the project. As an outcome of the study, we also expect an opportunity to present the model of technology readiness and factors to be taken care of in the ICT4D implementation to the concerned government authorities to improve the government service delivery to the citizens.

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