2011

An assessment of m-Health in developing countries using task technology fit model

Amina Tariq
University of New South Wales

Shahriar Akter
University of Wollongong, sakter@uow.edu.au

An assessment of m-Health in developing countries using task technology fit model

Abstract

Health challenges present arguably the most significant barrier to sustainable global development. The introduction of ICT in healthcare, especially the application of mobile communications, has created the potential to transform healthcare delivery by making it more accessible, affordable and effective across the developing world. However, current research into the assessment of mHealth from the perspective of developing countries particularly with community Health workers (CHWs) as primary users continues to be limited. The aim of this study is to analyze the contribution of mHealth in enhancing the performance of the health workers and its alignment with existing workflows to guide its utilization. The proposed research takes into account this consideration and aims to examine the task-technology alignment of mHealth for CHWs drawing upon the task technology fit as the theoretical foundation.

Disciplines

Business | Social and Behavioral Sciences

Publication Details

Tariq, A. & Akter, S. (2011). An assessment of m-Health in developing countries using task technology fit model. AMCIS 2011 Proceedings (pp. 1-12). Detroit, USA: Association for Information Systems.

AN ASSESSMENT OF M-HEALTH IN DEVELOPING COUNTRIES USING TASK TECHNOLOGY FIT MODEL

Amina Tariq
Australian Institute of Health Innovation
The University of New South Wales
amina.tariq@unsw.edu.au

Shahriar Akter
Australian School of Business
The University of New South Wales
s.akter@unsw.edu.au

ABSTRACT

Health challenges present arguably the most significant barrier to sustainable global development. The introduction of ICT in healthcare, especially the application of mobile communications, has created the potential to transform healthcare delivery by making it more accessible, affordable and effective across the developing world. However, current research into the assessment of mHealth from the perspective of developing countries particularly with community Health workers (CHWs) as primary users continues to be limited. The aim of this study is to analyze the contribution of mHealth in enhancing the performance of the health workers and its alignment with existing workflows to guide its utilization. The proposed research takes into account this consideration and aims to examine the task-technology alignment of mHealth for CHWs drawing upon the task technology fit as the theoretical foundation.

Keywords

mHealth, Task-Technology Fit, Developing countries.

INTRODUCTION

mHealth is transforming healthcare in developing countries by improving the quality of care. It has significantly facilitated information access, enhanced workflow, and promoted the evidence based practice to make informed and effective decisions directly at the point of care. It has dramatically improved the decision making and production processes of health and healthcare by ensuring the right information to the right person and at the right time.

Though mHealth is transforming healthcare in developing countries, it carries a number of risks including the risk of using technology that results in unintended widening of the gap in health status and knowledge between different sectors of the population; thereby increasing rather than addressing health inequity and digital divide (Khoja et al., 2008). mHealth researchers have agreement on the fact that sustainability of these initiatives is only possible by taking actions based on evidence generated by their rigorous assessment (Archer, 2009; Yu et al., 2008 Krishna et al., 2009; Kahn et al., 2010; Blaya et al., 2010). The assessment and outcomes evaluation needs to be designed from the outset and integrated into the implementation process to adequately inform the potential impact of mHealth based interventions to facilitate the decisions on their scope and scalability (Shields et al., 2005; Mechael, 2006). The primary assessment consideration therefore is to analyze the contribution of mHealth in enhancing the performance of the health workers and its alignment with existing workflows to guide its utilization (Iluyemi et al., 2007).

To date the studies in mHealth assessment have primarily focused on the acceptance of mHealth solutions by physicians and nurses with confinement to the hospital settings in the developed world (Chatterjee et al., 2009; Holden & Karsh, 2010; Junglas et al., 2009).There is lack of evidence on how mHealth is beneficial in connecting spatially distributed co-workers and enabling more efficient patient care (Prgomet et al., 2009; Chan & Kaufman, 2010). None of the existing frameworks has

been designed to assess suitability of mHealth in meeting the information and communication needs of front-line providers of health care; the CHWs (Kahn et al., 2010). This research therefore aims to fill this gap and develop mHealth assessment framework from the perspective of CHWs. The aim is to determine and analyze the individual; task, technology and context related factors that impact the mHealth adoption as well as performance of the CHWs. As in most of the developing world, mHealth is in its pilot stages this research will facilitate the developing countries on identifying the factors that need to be catered for building the capacity of the CHWs without which the innovation offered by mHealth will not translate into an embedded and sustainable benefit for the developing world (Dubow, 2006).

This research aims to take into account that simply focusing on CHWs perceptions of technology is not enough to prove their acceptance and success in the use of mHealth technologies (Lucas, 2008). To meet the contextual demands and critical nature of healthcare work; mHealth solutions need to fit with the tasks structures and enable performance optimization to prove their potential for sustainability (Zhou et al., 2010). Therefore; this research seeks to analyze the determinants of CHWs' performance taking into account the new mHealth enabled work settings and individual capabilities of the CHWs to match them, in the remote and rural environments of the developing world.

LITERATURE REVIEW

This section aims to describe the context and vision of the proposed research. It begins with an overview of the research context placed in the domain of mHealth solutions in the developing countries and goes on to consider the prospective role of Community Health Workers (CHWs) in the enablement of mHealth in the developing world. This leads to a development and validation of the TTF based conceptual model for mHealth in developing countries from the perspective of CHWs.

mHealth in Developing Countries

Electronic health (e-health) is defined as the embryonic convergence of wide reaching technologies like the internet; computer and wireless technologies enabling direct access to healthcare providers and services including primary care; health education and wellness (DeLuca & Enmark, 2000; Brommey, 2003). Researchers identify 'mHealth' or Mobile Health as an inextricable subset of e-health in which the provision of health-related services is made via mobile Information and communication technologies (MCITs) (Mechael, 2009; Ivatury et al., 2009; Krishna et al., 2009; Vodafone, 2009). The conceptual background of mHealth lies in the vision of Pervasive Health care which is defined as the ability to realize health care to anyone; anytime and anywhere by removing geographic; time and other restraints while increasing both the coverage and the quality (Varshney, 2005, 2007). Mobile based health care technologies are considered both emerging and enabling for their vast scope of applications as summarized in Figure 1 (Kuzeimsky, 2005; Jen & Wung, 2010; Finch, 1999; Ammenwreth et al., 2000; Lu et al., 2005; Prgomet et al., 2009). mHealth therefore is considered not only as technological innovation but as a paradigm shift; promising healthcare improvement around the globe (Curioso & Mechael, 2010).

Emergency response systems (road traffic accidents, emergency obstetric care, etc.)
Disease surveillance and control (Malaria, HIV/AIDS, TB, Avian Flu, chronic diseases- esp. diabetes)
Human resources coordination, management, and supervision
Synchronous and asynchronous mobile telemedicine diagnostic and decision support for clinicians at point-of-care
Remote patient monitoring and clinical care
Health extension services, health promotion, and community mobilization
Health services monitoring and reporting
Health-related m-learning for the general public
Training and continuing professional development for health care workers

Figure 1: Perceived Benefits of mHealth (Mechael, 2006)

MCITs are one of those rare set of technologies where industry has reported a reverse trend in digital divide (Krishna et al., 2009; Banks & Burge, 2004; Sutherland, 2009). In developing countries the importance of mHealth systems is manifolds

because they could act as a catalyst for providing basic health services to the patients who live in remote and rural areas; where health care facilities are either non-existent or of extremely poor quality (Curioso& Kurth, 2007; Kahn et al., 2010). The concept of remote and rural environments is defined as an environment in which the majority of population adheres to the culture; social norms and religion of their ancestors – leaving no room to accept change in them. Consequently; the environment is invariant in time and space. Its users show significant amount of resistance to advancements in the society. Their cognitive faculties are not evolved to formulate their requirements or expectations from a given system (Hsiao, 2009; Blaya et al., 2010).

Community Health Workers- Prime stakeholders of mHealth

In remote and rural areas of the developing world, Community Health Workers (CHWs) are the main and sometimes only link between the patient and other social services (Fitch & Adams, 2006). CHWs embrace a variety of community health aides selected; trained and working in the communities from which they come. Although it is hard to generalize the profile of CHWs on a global scale a common ground in the definition is that CHWs must respond to local societal and cultural norms and customs to ensure community acceptance and ownership (Lehmann & Sanders, 2007). The foremost responsibility of CHWs is to provide primary health care services including support for vulnerable groups; such as the elderly; less mobile and newly born infants (Fitch & Adams, 2006; Haines et al., 2007). CHWs vary greatly in literacy levels and receive little refresher training; therefore require reliable and timely information access to support task accomplishment (Sherwani et al., 2007; Walsh et al., 1997). Despite their constant information & communication requirements, CHWs are often working alone and have little or no access to up to date information and opportunities to exchange experience with colleagues (Dubow, 2006). Researchers believe that mobile technologies can enable real time access to key clinical information; expertise and patient administration to facilitate the CHWs in successful execution of their healthcare tasks (Sherwani et al. 2007; Fitch &Adams 2006). Realizing the potential inherent in mHealth solutions; mHealth is gaining swift progress in the developing world; as reported in 2008 alone over a dozen mHealth applications have been implemented or are in trial stage to revamp the health infrastructure in remote and rural environments with CHWs as the prime users (Curioso & Kurth, 2007; Vodafone, 2009; Ivatury et al., 2009).

However; enabling mHealth acceptance by CHWs requires overcoming a number of social and acceptance challenges which include (1) winning hearts and minds of CHWs; (2) taking into account the cultural issues such as the use of language and illustrations; privacy and trust(3) alignment with CHWs processes & tasks; (4) reliable data collection; (5) setting up and configuring the devices; and doing their calibration and maintenance; (6) maintaining a synchronous interactivities with the physicians (7) accessibility issues (8) the presentation medium and (9) Affordability (Niman et al., 2006; Mechael, 2009). It is critical to understand such calling preferences and patterns in order to understand the natural role of mobile phones within the CHW's work settings to gain the desired benefits (Kaplan, 2006; Haines et al., 2007; Mechael, 2009). Further; attributed to their varying skill set and vulnerable nature; there is a requirement of continuous support and training for CHWs to maintain the effective contribution (Lehmann & Sanders, 2007). Therefore; a critical challenge for remote and rural environments is the technology transfer taking into account the cultural considerations and customizing the mHealth solutions with locally developed content supported by appropriate technologies in alignment with the conditions and realities of their application context (Lacal, 2003).

Existing mHealth Assessment Framework

Prior to establishing a theoretical ground for proposed research a detailed literature survey was undertaken to analyze the state of the art of mHealth assessment its suitability for context of this research (Table 1). The review indicated that evidence of mHealth's success in clinical practice and research is still evolving. The common observation is the agreement on the inherent complexity of mHealth assessment. There is an acceptance of the notion that mHealth has very diverse stakeholders with starkly differing needs; therefore one-size-fits-all is a failed model for mobile computing in healthcare (Basole & Rouse, 2009, Myers & Baskerville, 2002). As discussed earlier, negligible mHealth research has been done focusing on developing countries particularly in remote practice settings with CHWs as the primary users (Chan & Kaufman; 2010). The existing literature has tendency to view the mobility of any device as inherently beneficial without clear evidence demonstrating how, why or in what circumstances this mobility provides value (Baumgart; 2005). Another major limitation of existing studies is focus primarily on Physicians; ignoring other types of mHealth professionals (especially community health workers in developing world); their relationships and distinct context of use.

Researchers have emphasized on need for more evidence-based approach to the use and evaluation of mobile technologies to understand if, and when, they are useful in supporting clinical practice (Kaplan & Harris-Salamone, 2009). Researchers (Klecun & Cornford, 2005) emphasize that IS innovations, are socially and historically conditioned, and any evaluative activity has to both reflect and respond to such conditions. They recommended adoption of critically informed methods

especially in context of healthcare settings that encompasses technical, individual and organizational characteristics, as well as a societal perspective to address the long-term prospects of a project, that is, its sustainability, as well as changes to work practices.

Study	Model	Evaluated Constructs
Barret et al.(2004)	TAM	PDA Usage & Perceived Needs
Yi et al.(2006)	TAM, TPB & IDT	Behavioral Intention based on PU, PEOU, Personal Innovativeness, Subjective Norm, Image, Perceived Behavioral Control
Wu et al. (2007)	TAM & IDT	Behavioral Intention based on PU, PEOU, technical support and training, MHS Self Efficacy and Compatibility.
Yu et al. (2009)	TAM	User acceptance based on PU, PEOU, data quality, work flow and cost
Liang et al. (2004)-	TAM & IDT	Actual Usage based on PU, PEOU, Personal Innovativeness, job relevance & compatibility.
Vishwanath et al. (2009)	TAM	Actual use of PDA based on PU, PEOU, attitudinal landscape, adoption readiness.
Yusof et al. (2008a)	IS success	System Quality, Information Quality, Service Quality, System Use, User Satisfaction, Organizational Structure, Organizational Environment and Net Benefits.
Chatterjee et al. (2009)	IS success	System quality, Nature of work, Service quality, Usage, Satisfaction and Net Benefits

Table 1. Review of major mHealth studies

Rationale for Task-Technology Fit Perspective

To fill the above mentioned gaps in mHealth assessment research, proposed research aims to draw on the theoretical perspectives of Task Technology Fit (TTF) theory (Goodhue, 1995, Goodhue & Thomson, 1995). Figure 1, which argues that technology needs to be willingly accepted as well as fit well with the users and their corresponding tasks to prove its effectiveness (Lee et al., 2007; Sun et al., 2009). The ability of TTF to predict performance is argued to be its vital contribution in contrast to Technology acceptance model (TAM) (Davis, 1989) which focuses on usage prediction only (Goodhue et al., 2000). Moreover in contrast to TAM, TTF focuses on utilization rather than intention to use which does not necessarily lead to actual use (Dishaw & Strong, 1998). Therefore to analyze adoption in specific contexts researchers have emphasized application of TTF rather than reliance on TAM (Benbasat & Barki's, 2007).

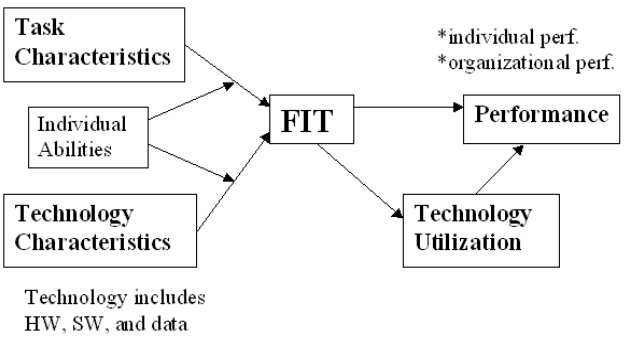

Figure 1: Basic TTF model (Goodhue, 1995)

TTF can be the guiding perspective for mHealth researchers to identify the key elements of a behavioral model of IS use in emerging context of mHealth in the remote and rural areas of the developing countries (Rai et al., 2002). There is a need to contextualize TTF constructs to cater for with the unique issues offered by the dual administrative structure of healthcare in these environments. However contextualization needs to be general enough to encompass the complete view of healthcare settings (Chiasson & Davidson, 2004). This would facilitate then in eradication of actual barriers in the success of mHealth initiatives and realization of ubiquitous healthcare, for conservative environments (Kaplan, 2006). TTF has been combined or extended with famous IS models like TAM to explain user adoption of technology (Dishaw & Strong, 1999). It has been used as the baseline model to explain user's evaluation of blogs, web usage, evaluate synchronous and asynchronous group communication, ERP System adoption and Artificial Intelligence Systems (Shiraniet al., 1999, D'Ambra and Wilson, 2004a & 2004b, IPKawai, 2005, Wongpinunwatana et al., 2000). Recently the TTF has been employed for studying the adoption of mobile based systems in different industry sectors including insurance, mobile banking and mobile based location systems (Lee et al., 2007, Zhou et al., 2010 & Junglas et al., 2008). In our study, a synthesis of TTF research developed in the context of mobile technologies was undertaken to draw its relevance to the perspective of mHealth as presented in Table 2.

Study	Applied Domain	Key Research Questions	Methodological Details	Major Findings
(Lee et al., 2007) **TTF model extended with a new construct of *"Individual Differences"***	**Insurance Industry**	•Evaluate applicability of PDA in insurance industry •Determine the cognitive fit's impact on mobile adoption of insurance agents •Determine the Technological and Task factors for selecting appropriate mobile solutions for insurance agents	•Case Study •Positivist Approach •Survey of a US based multi-national insurance company •Sample Size: 238 (Insurance Agents) •Analysis using Multiple Regression	•Position Experience, Cognitive Fit and Computer Self Efficacy major fit Factors for insurance industry •PDA suitable mostly for post-contract customer services
(Zhou, 2010) **"TTF & UTAUT"**	**Mobile Banking User Adoption**	•Determine if TTF impacts the User adoption as well as Performance Expectance . •Remaining similar to (Goodhue et al. 1995 & Venkatesh et al. 2003)	•Positivist Approach •Survey conducted in China •Convenience Sampling •Sample Size: 250 (Students + Professionals) •SEM Analysis using LISERL	•Performance Expectancy, TTF, Social Influence and facilitating conditions have significant effect on user adoption
(Junglas et al., 2008) **TTF model revised with location sensitivity and mobility measures**	**Mobile Locatable Information Systems**	•Determine if ideal TTF will lead to higher individual performance than over-fit. •Determine if ideal TTF will lead to higher individual performance than under-fit.	•Positivist Approach •Wireless Lab Experiment with 112 subjects (IS students) in US •Four Technology Treatment groups •Non-Parametric Analysis	•Subjects perceive differences between under and ideal fit conditions when tasks include localization components
(Delbert et al. 2009) **Task, Technology & Information characteristics and TTF**	**Construction Industry**	•Determine process performance factors from information processing perspective •Impact of mobile technologies on the above relationship	•Positivist Approach •Scenario based 3D lab Experiment with 20 Subjects •Analysis using PLS techniques	•Positive effect of Mobile technology depends on the task complexity as well as on the used technology.

Table 2. Summary of major mHealth studies on TTF

The above evidence on application of TTF confirms Zigurs's (1998) assertion that there is no generally accepted definition or standard for task technology fit it needs to be extended, modified or integrated with different theories and constructs based on its study context (Cane & Mcarthy, 2009).

Conceptual Model

In order to conceptualize a task technology fit model for mHealth perspectives, this study began by investigating commonly cited factors that influence TTF theory in mHealth settings. As such, it identified seven factors that influence task technology fit in mHealth context (Table 3). These seven factors are CHW's task characteristics, individual characteristics, technology characteristics, work environment characteristics, perceived task technology fit, mHealth utilization and performance. Based on the following conceptualization of TTF Model in mHealth context, the preliminary conceptual model of the study is presented in Figure 2. However it is vital to clarify that this model will serve just as the initial theoretical premises of the research and will be revised with the iterative cycles of research execution. Based on the conceptual model depicted in Figure 2, the research propositions and their supporting theories have been presented in Table 4.

Concept	Definition
CHW's Task Characteristics	Tasks are action taken by CHWs to turn input into output. Task characteristics are those features of the task that move CHWs to rely heavily on mHealth technologies.
CHW's Individual Characteristics	Individual characteristics are the capabilities of CHWs which affect how well and easily they use mHeath technologies to execute their tasks.
mHealth Technology Characteristics	Technology characteristics describe the features of the complete set of tools including the mHealth applications; enabling infrastructure and services that enable task execution by CHWs.
Work Environment Characteristics (Contextual)	Work Environment Characteristics describe the social and cultural influences as well as the facilitating conditions of the CHWs work environment which influence CHWs perceptions on suitability of mHealth in their work settings
CHW's Perceived Task Technology Fit	The correspondence between CHWs task requirements, their individual capabilities and the functionalities of the provided mHealth technologies
CHW's mHealth Utilization	Utilization represents the actions of CHWs using mHealth applications to complete their tasks. It represents whether mHealth technologies are used or not and does not relies only on usage duration.
Performance	Performance implies improved efficiency; effectiveness and quality in CHW's task accomplishment.

Table 3: Conceptualization of Constructs (based on Goodhue & Thomson, 1995 ; Gebauer et al., 2007)

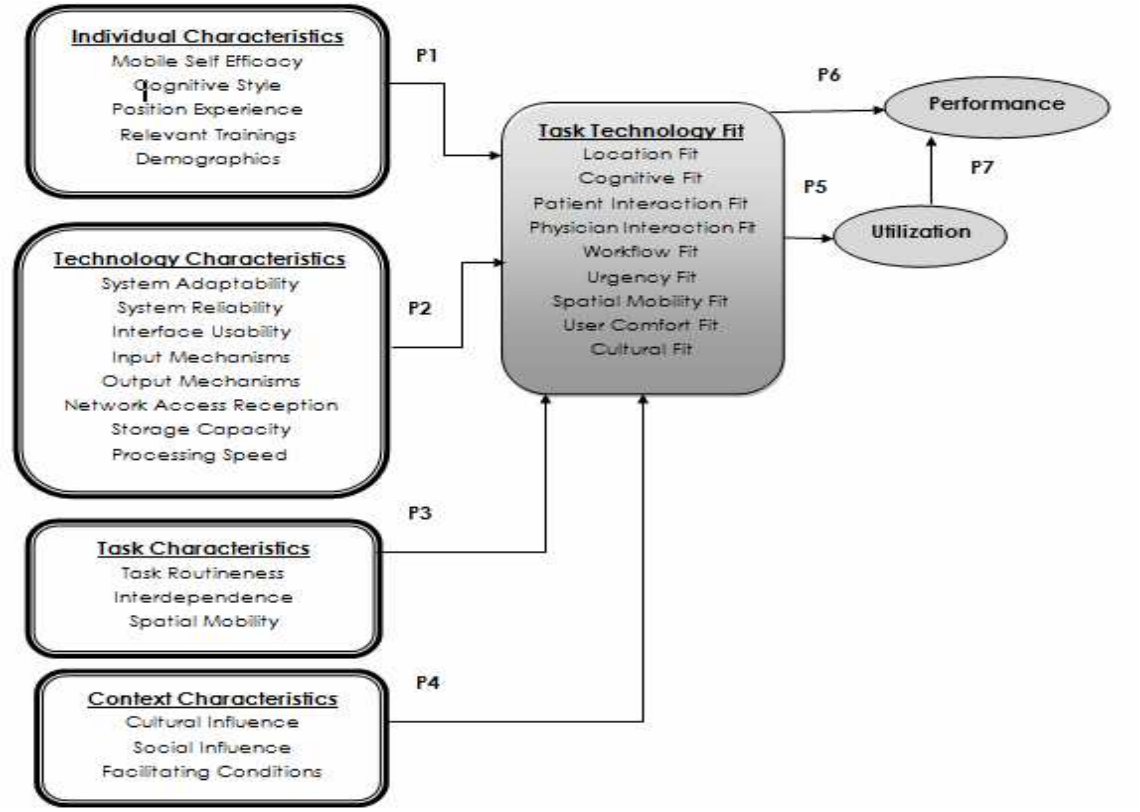

Figure 2: Preliminary Conceptual Model

No.	Propositions	**Theory**
P1	CHW's perceptions of task technology fit are influenced by differences in their individual characteristics.	Goodhue & Thomson 1995; Gebauer & Tang 2008
P2	CHW's perceptions of task technology fit are influenced by the characteristics of the employed mHealth technology.	Goodhue et al. 2000, Wu et al. 2007, Lee et al. 2007, Venkatesh et al. 2003
P3	CHW's perceptions of task technology fit are influenced by the characteristics of tasks being performed.	DeLone & McLean 2003, Parasuraman 2005, Varshney 2005
P4	CHW's perceptions of task technology fit are influenced by the characteristics of their working environment (context).	Venkatesh et al. 2003, Staples & Seddon 2004; Zhou et al. 2010
P5	The perceived task technology fit influences the utilization of mHealth technologies by CHWs.	Goodhue 1998, Junglas et al. 2009
P6	CHW's perceptions of task technology fit influence the performance of CHWs using mHealth.	Goodhue & Thompson 1995, Junglas et al. 2009
P7	The utilization of mHealth by CHWs influences the performance impact of CHWs using mHealth.	Goodhue & Thomspon 1995, Karsh et al. 2009, Holden & Karsh 2009

Table 4: Summary of preliminary research propositions

RESEARCH METHODOLOGY

Researchers believe that a single research approach cannot encompass the three main criteria of research including generalization; control and measurement of research variables and existential realism (McGrath; 1981). Therefore the selection of research design is driven by aims and objectives of the research.

Research Methodological Approach

As this research aims to study mHealth utilization by CHWs in the developing world which is a contemporary issue and cannot be studied outside its occurring research context (Ivatury et al.; 2009) therefore, case study is the appropriate strategy (Myers, 1997; Walsham, 1993). Case study strategy is chosen for its ability to provide profound insights into this specific application context of mHealth (Darke et al., 1998). Further the lack of control of the researcher on the events occurring in the research environments (mHealth in remote or rural environments) also justifies the suitability of case study (Yin; 1994).

Case study strategy is known in literature as a triangulated research strategy (Yin, 1994; Pare and Elam, 1997; Eisenhardt, 1989). It is acknowledged as one of the most common research approaches in IS domain; attributed to its ability to analyze multiple perspectives with in a specific context employing diverse set of data collection methods (Orlikowski & Baroudi, 1991; Ritchie et al., 2003). The case study does not represent an empirical sample; its aim is to achieve analytic generalization rather than statistical generalization (Yin, 1994). The phenomenon under study varies with social-cultural idiosyncrasies and environmental complexity. Therefore it's inappropriate to directly test findings of other research in this context (Darke et al., 1998). In context of this research, positivist case methodology is adopted which is recommended by researchers in context of health informatics (Pare, 2002, Cavaye, 1996). A positivist case study can generate both qualitative and quantitative types of data and the two types inform each other (Bryman, 2001, Gillham, 2000). In the following sections, this study aims to discuss the case study design to investigate the proposed research questions.

Multiple Case Study Design

Yin (1994) explains that a single case can provide a full and rich description of a rare phenomenon and contribute to knowledge. However, it cannot verify findings that might be the result of idiosyncrasies of the research setting (Cavaye; 1996). In context of this research as the aim is to understand the impact of remote or rural environments in the developing world with varying social; cultural and political context a single case design will make it harder to achieve theoretical saturation. In contrast; the multiple-case design enables cross-case comparison and verifies findings derived from different cases. This research therefore investigates the task technology alignment of CHWs in remote or rural environments by employing multiple case studies to triangulate evidence and verify research findings.

Triangulation of evidence from multiple will significantly improve the theoretical saturation of this study; therefore contributing validity of mHealth assessment research where only a handful of studies tend to look for complementing or congruent findings by applying of multiple methods on primary data (Ammenwerth, et al. 2003; Jaspers, 2008). Further; in context of remote or rural environments aim is to dig deeper and identify the barriers in the scalability of mHealth pilot projects. For this purpose it is vital to collect different kinds of data from CHWs. Adoption of triangulation will yield somewhat different results due to sensitivity of each method to the context in which it is being applied. The identification and analysis of these inconsistencies can be illuminative and will offer deeper insight into the relation between the methods and variables under study. Therefore triangulation seems a viable methodology to conduct the proposed research (Hesse & Schneiderman, 2007).

The choice of the number of case studies depends on the nature of investigation and availability of resources (Patton, 1990). In the proposed research time and resources are constrained to take a large number of case studies. Presently there are only limited numbers of mHealth projects in the remote or rural environments (Vodafone, 2009); with most of them in their pilot stages. Also getting access to the CHWs and conducting field studies requires overcoming various social barriers with serious privacy and ethical concerns.

Embedded Case Design

To conduct this research within time and resource limitations, multiple case studies within one country, that is, Pakistan will be examined. Case studies will be based on three distinct pilot mHealth projects in different regions of Pakistan. These mHealth projects are under progress in different provinces of Pakistan having different cultures and health care infrastructures. Further the underlying mHealth technologies for each project are different (Ivatury et al., 2009; Vodafone,

2009; Sherwani et al., 2009). In this sense, each mHealth project is identified as single case and all the cases are embedded in one case of setting; remote or rural environments in Pakistan.

Unit of Analysis

In context of this research, each case is identified as a mHealth project for remote or rural environments involving its utilization by CHWs. Maintaining the focus on CHWs; this research does not examines impact of mHealth on other stakeholders however their impact on CHWs adoption of mHealth would be catered for as part of the research.

Research Process Design

Figure 3 presents the phase wise design of the research. Initial phases focus on streamlining the preliminary framework and establishing research protocol. This will be followed by a cyclic data collection and analysis phase (Miles & Huberman, 1984, 1994). Last two phases will focus on evaluating and revising the framework revising the framework based on the analysis of the obtained data. As this research adopts multi-case study approach number of iterations of phases may vary in different case studies.

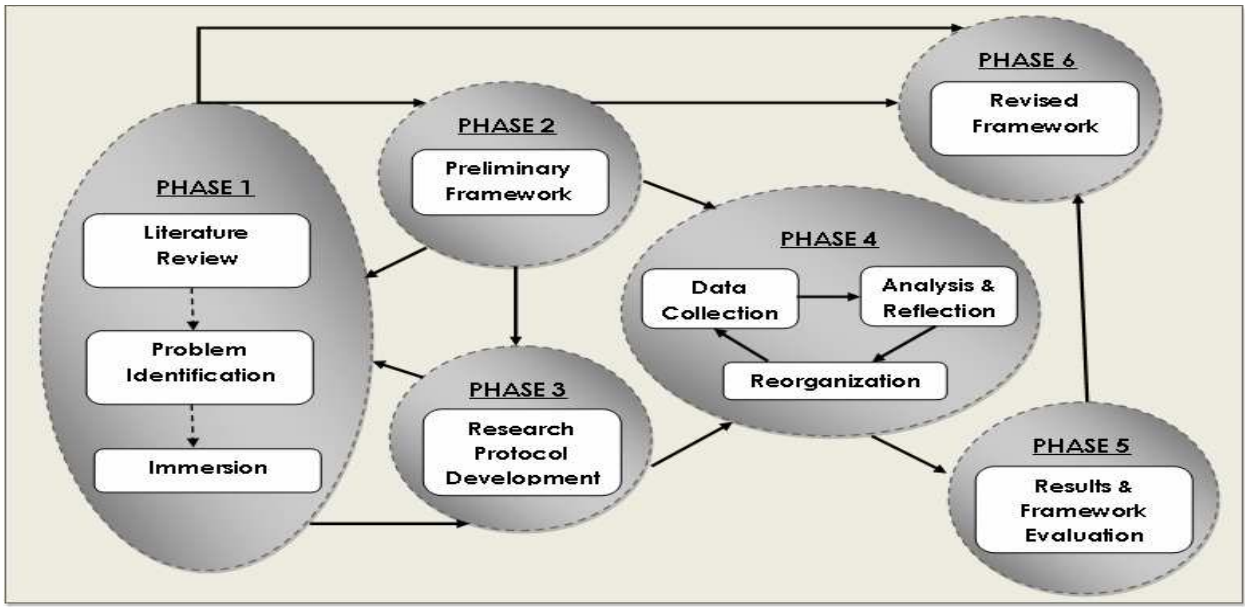

Figure 3: Research process design (adapted Freidman & Wyatt (1997); Kaplan (1997))

Data Collection Approach and Methods

The data collection approach of the research selected to ensure that the research follows protocols of the case study research (Klein & Myers 1999). It is important to clarify that the data gathering techniques can be different for different stages and evolving requirements of the research.

CONCLUSION

The proposed research aims to examine the task-technology alignment of mHealth for CHWs drawing upon the task technology fit as the theoretical foundation. Based on extensive literature review, a preliminary conceptual framework is presented to investigate the task technology alignment of mHealth for CHWs and examine its impact on their performance. By successively building upon the initial framework this research proposes a guiding set of methods in the form of a methodology. This research takes into account the socio-technical nature of mHealth domain, therefore, our proposed research methods will allow the examination of relationships between social and technical subsystems prevailing in the developing world in order to facilitate the assessment of mHealth.

REFERENCES

1. Ammenwerth, E., Buchauer, A., Bludau, B., & Haux, R. (2000) Mobile information and communication tools in the hospital. *International Journal of Medical Informatics, 57*(1), 21-40. doi:DOI: 10.1016/S1386-5056(99)00056-8
2. Archer, N. (2007) Mobile e-Health: Making the Case, *In Mobile Government: An Emerging Direction in E-Government*, I. Kushchu, ed., IGI Global.
3. Banks, K. & Burge, R. (2004) *Mobile Phones: An Appropriate Tool for Conservation And Development?* Cambridge: Fauna & Flora International.
4. Basole, Rahul C. and Rouse, William B. (2009) Enterprise Readiness for ITS Innovation: A Study of Mobile Computing in Healthcare *ICIS 2009 Proceedings.* Paper 104.http://aisel.aisnet.org/icis2009/104
5. Berg; B. L. (1989) *Qualitative Research Methods for the Social Sciences*; Allyn and Bacon; Boston.
6. Blaya; J.A.; Fraser; H.S.F. & Holt; B. (2010) E-Health Technologies Show Promise In Developing Countries; *Health affairs;* vol. 29; no. 2; pp. 244-251.
7. Benbasat; I.; & Barki; H. (2007) Quo Vadis; TAM? Journal of the Association for Information Systems; 8(4); 21 1-218.
8. Blynn, E. 2009, Piloting mHealth: A Research Scan data sheet, report, *Management Sciences for Health available at : http://mobileactive.org/research/piloting-mhealth-research-scan (accessed 4th April 2010)*
9. Chan, C.V. & Kaufman, D.R. (2010) A technology selection framework for supporting delivery of patient-oriented health interventions in developing countries, *Journal of Biomedical Informatics,* vol. 43, no. 2, pp. 300-306.
10. Chatterjee; S.; Chakraborty; S.; Sarker; S.; Sarker; S. & Lau; F.Y. (2009) Examining the success factors for mobile work in healthcare: A deductive study; *Decision Support Systems;* vol. 46; no. 3; pp. 620-633.
11. Cane; S.; & McCarthy; R. (2009). Analyzing the factors that affect information systems use: A task-technology fit meta-analysis. *Journal of Computer Information Systems; 50*(1); 108-123.
12. Curioso, W. H., & Mechael, P. N. (2010) Enhancing 'M-health' with south-to-south collaborations. *Health Affairs, 29*(2), 264-267. doi:10.1377/hlthaff.2009.1057
13. Curioso, W. & Kurth, A. (2007) Access, use and perceptions regarding Internet, cell phones and PDAs as a means for health promotion for people living with HIV in Peru, *BMC Medical Informatics and Decision Making,* vol. 7, no. 1, pp. 24.
14. Davis; F. D. (1989) Perceived usefulness; perceived ease of use; and user acceptance of information technology. *MIS Quarterly*; 13(3); 319-340.
15. Davis; F. D.; Bagozzi; R. P.; & Warshaw; P. R.; (1989) User acceptance of computer technology: A comparison of two theoretical models. *Management Science*; 35; 982-1003.
16. Dishaw; M. T.; & Strong; D. M. (1999) Extending the technology acceptance model with task–technology fit constructs. *Information & Management; 36*(1); 9-21. doi:DOI: 10.1016/S0378-7206(98)00101-3
17. D'Ambra; J.; & Wilson; CS. (2004b) Use of the World Wide Web for International Travel: Integrating the Construct of Uncertainty in Information Seeking and the Task-Technology Fit Model. *Journal of the American Society for Information Science and Technology;* 55(8); 731-742.
18. DeLone; W. H.; & McLean; E. R. (1992) Information systems success: The quest for the dependent variable. *Information Systems Research; 3*(1); 60-95. doi:10.1287/isre.3.1.60
19. DeLone; W. H.; & McLean; E. R. (2003) The DeLone and McLean Model of Information Systems Success: A ten-year update. *Journal of Management Information Systems; 19*(4); 9-30.
20. Deluca; J.; & Enmark; R. (2000) *E*-health: The changing model of healthcare. *Frontiers of Health Services Management; 17*(1); 3-15.
21. Flick; U. (1992). Triangulation revisited: Strategy of validation or alternative? *Journal for the Theory of Social Behaviour; 22*; 175-197.
22. Fitch; C. J.; & Adams; C. (2006) Managing mobile provision for community healthcare support: Issues and challenges. *Business Process Management Journal; 12*(3); 299-310.
23. Finch, C, (1999) Mobile computing in healthcare, *Health Management Technology* (20:3), pp. 64-65.

24. Goodhue; D.L. and Thompson; R.L. (1995) Task-Technology Fit and Individual Performance;. MIS *Quarterly* (19:2); pp. 213-236.

25. Goodhue; D.L.; (1995) Understanding User Evaluations of Information Systems; *Management Science* (41:12); pp. 1827-1844.

26. Heeks; R. (2006) Health information systems: Failure; success; and improvisation. *International Journal of Medical Informatics*; 75; 125-137.

27. Holden, R.J. & Karsh, B. (2010) The Technology Acceptance Model: Its past and its future in health care, *Journal of Biomedical Informatics,* vol. 43, no. 1, pp. 159-172.

28. Hsiao; S.; Li; Y.; Chen; Y. & Ko; H. (2009) Critical Factors for the Adoption of Mobile Nursing Information Systems in Taiwan: the Nursing Department Administrators' Perspective; *Journal of medical systems;* vol. 33; no. 5; pp. 369.

29. Haines; A.; Sanders; D.; Lehmann; U.; Rowe; A. K.; Lawn; J. E.; Jan; S.; Walker; D. G.; & Bhutta; Z. (2007) Achieving child survival goals: Potential contribution of community health workers. *The Lancet; 369*(9579); 2121-2131. doi:DOI: 10.1016/S0140-6736(07)60325-0

30. Iluyemi; A.; Fitch; C.; Parry; D.; & Briggs; J. (2007) Health Information Systems for Community Based Health Workers: A Case for Mobile and Wireless Technologies. In P. Cunningham; & M. Cunningham (Eds.); *IST-Africa 2007.*

31. Ivatury; G.; Moore; J. & Bloch; A. (2009) A Doctor in Your Pocket: Health Hotlines in Developing Countries; *Innovations: Technology; Governance; Globalization;* vol. 4; no. 1; pp. 119-153.

32. Jen; W. & Hung; M. 2010; An Empirical Study of Adopting Mobile Healthcare Service: The Family's Perspective on the Healthcare Needs of Their Elderly Members; *Telemedicine and e-Health;* vol. 16; no. 1; pp. 41-48.

33. Junglas; I.; Abraham; C.; & Watson; R. T. (2008) Task-technology fit for mobile locatable information systems. *Decision Support Systems; 45*(4); 1046-1057. doi:DOI: 10.1016/j.dss.2008.02.007

34. Junglas; I.; Abraham; C.; and Ives; B.; (2009) Mobile technology at the frontlines of patient care: Understanding fit and human drives in utilization decisions and performance; *Decision Support Systems* (46:3);pp. 634-647.

35. Kaplan, B., & Maxwell, J. A. (1994) Qualitative research methods for evaluating computer information systems. In J. G. Anderson, C. E. Aydin, & S. J. Jay (Eds.), *Evaluating health care information systems, methods and applications* (pp. 45-68). Thousand Oaks, CA: Sage.

36. Khoja S.; Scott RE.; Casebeer A.; Gilani SN.; Mohsin M.; Ishaq AFM.; (2007) 'e-Health Readiness assessment tools for healthcare institutions in developing countries'. '*Telemedicine and eHealth'*. Volume 13 (4); Aug 2007: 425-432.

37. Krishna, S., Boren, S.A. & Balas, E.A. (2009) Healthcare via Cell Phones: A Systematic Review, *Telemedicine and e-Health,* vol. 15, no. 3, pp. 231-240.

38. Kuziemsky, C.E., Laul, F. & Leung, R.C. (2005) A Review on Diffusion of Personal Digital Assistants in Healthcare, *Journal of medical systems,* vol. 29, no. 4, pp. 335-342.

39. Kaplan, W. (2006) Can the ubiquitous power of mobile phones be used to improve health outcomes in developing countries? *Globalization and Health, 2*(1), 9.

40. Lehmann U and Sanders D. (2007) Community health workers: what do we know about them? The state of the evidence on programmes; activities; costs and impact of health outcomes of using community health workers. World Health Organization.

41. Lacal; J. (2007) Feedback on Draft WHO mHealth Review. (Personal communication). *N*ew York.

42. Lu, Y.-C., Xiao, Y., Sears, A., and Jacko, J.A. (2005) A review and a framework of handheld computer adoption in healthcare, *International Journal of Medical Informatics* (74:5), pp. 409-422.

43. Lucas; H. (2008) Information and communications technology for future health systems in developing countries. *Social Science and Medicine; 66*(10); 2122-2132.

44. Lacal; J. (2007) Feedback on Draft WHO mHealth Review. (Personal communication). New York.

45. Mechael, P.N. (2009) The Case for mHealth in Developing Countries, *Innovations: Technology, Governance, Globalization,* vol. 4, no. 1, pp. 103-118.

46. McGrath; J.E.; Martin; J. & Kulka; R.A.; (1981) Some Quasi-Rules for Making Judgement calls in Research; American Behavioral Scientist; 25; pages 211-224.

47. Miles; M.M. & Huberman; A. M. (1984) *Qualitative data analysis: A sourcebook of new methods*. Newbury Park; CA: Sage.
48. Myers; M.D.; (1997) Qualitative research in information systems; *MIS Quarterly*; 21(2): 241-2
49. Myers; D. G. (2002) *Social Psychology (7th ed.).* New York; NY: McGraw-Hill.
50. Myers, M.D. and Baskerville, R.L., (2002) Information systems as a reference discipline. *MIS Quarterly* 26 1, pp. 1–14
51. Neuman; W. L. (2006). *Social Research Methods: Qualitative & Quantitative Analysis(6th ed.)*; Boston; MA: Allyn & Bacon.
52. Niman; NB.; T. Sund; A. Rodriguez-Ascaso; S. Brown (2006) User experience design guidelines for ubiquitous; mobile telecare services; 8th International Conference on e-Health Networking; Applications and Services; *HEALTHCOM*; pp. 269-272.
53. Orlikowski; W.J. & Baroudi; J.J. (1991) Studying Information Technology in Organizations: Research Approaches and Assumptions; *Information Systems Research* (2); pp. 1-28.
54. Pare; G.; Elam; J. J. (1997) Using Case Study Research To Build Theories Of IT Implementation. in *Information Systems And Qualitative Research: Proceedings Of The IFIP TC8 WG 8.2 Conference On Information Systems And Qualitative Research*; Philadelphia; Pennsylvania; 542-569.
55. Patton; M. Q. (1990) *Qualitative evaluation and research methods (2nd ed.*); Newbury Park; CA: Sage.
56. Prgomet; M.; Georgiou; A. & Westbrook; J.I. (2009) The Impact of Mobile Handheld Technology on Hospital Physicians' Work Practices and Patient Care: A Systematic Review; *Journal of the American Medical Informatics Association;* vol. 16; no. 6; pp. 792-801.
57. Rai, A., Lang, S. S., & Welker, R. B. (2002) Assessing the validity of IS success models: An empirical test and theoretical analysis. *Information Systems Research, 13*(1), 50-69. doi:10.1287/isre.13.1.50.96
58. Sutherland; Ewan; Counting Mobile Phones; Sim Cards & Customers (13th March 2010). Available at SSRN: http://ssrn.com/abstract=1468847
59. Sherwani; J. Sooraj Palijo; Sarwat Mirza; Tanveer Ahmed; Nosheen Ali; Roni Rosenfeld. (2009) Speech vs. Touch-tone: Telephony Interfaces for Information Access by Low Literate Users. In *Proc. Information & Communications Technologies and Development*; Doha; Qatar.
60. Shields; T.; Chetley; A.; & Davis; J. (2005) ICT in the health sector: Summary of the online consultation: infoDev
61. Varshney ;U. (2007) Pervasive healthcare and wireless health monitoring; *Mobile Networks and Applications*; 12 (2-3); pp. 113-127.
62. Varshney; U. (2005) Pervasive Healthcare: Applications; Challenges and Wireless Solutions; *Communications of the Association for Information Systems*; 16(3); 2005; 57-72
63. Walsham; G. (2006) Doing interpretive research. *European Journal of Information Systems*; 15(3)320-330
64. Walsham; G.; Robey; F. and Sahay; S. (2007) Foreword: special issue on information systems in developing countries. *MIS Quarterly*; 31(2): 317-326
65. Yin; R. K. (1994) *Case study research: Design and methods. (2nd Ed.) Newbury Park: Sage*
66. Yu, P., de Courten, M., Pan, E., Galea, G. & Pryor, J. (2008) The development and evaluation of a PDA-based method for public health surveillance data collection in developing countries , *International journal of medical informatics,* vol. 78, no. 8, pp. 532-542.
67. Zigurs;Ilze;Buckland;Bonnie K. (1998) A theory of task/technology fit and group support systems effectiveness *MIS Quarterly*; 22; 3; 313-334.
68. Zhou; T.; Lu; Y.; & Wang; B. (2010) Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior; In Press; Corrected Proof* doi:DOI: 10.1016/j.chb.2010.01.013