Human Development and Interaction in the Age of Ubiquitous Technology

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Chapter 10
Managing Seven Dimensions of ICT4D Projects to Address Project Challenges

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ABSTRACT

A large number of ICT for development (ICT4D) projects experience a variety of challenges, especially when conducting field research with disadvantaged communities in developing nations. Using cluster analysis, this chapter identifies the six most common factors associated with a majority of ICT4D project challenges, and depicts the inter-relationship between these factors and over 100 distinct challenges reported by existing literature. In addition, based on the secondary analysis of 380 research artifacts in the ICT4D literature, this chapter proposes ways to manage the scope, time, costs, quality, human resources, communication, and risks for addressing ICT4D project challenges. Findings inform researchers of best practices for conducting ICT4D research with disadvantaged communities in developing nations.

BACKGROUND

Projects which (a) design information and communication technology (ICT) solutions for disadvantaged communities, (b) test ICT prototypes with disadvantaged communities, (c) deploy ICT solutions in disadvantaged communities, or (d) assess the impact of ICT solutions on the development of disadvantaged communities in developing nations are known as ICT4D projects (Potnis, 2014). A large number of ICT4D projects experience a variety of challenges, especially when conducting field research with disadvantaged communities in developing nations. In addition, most ICT4D projects have limited resources, including time and money, which are often subjected to identified or unforeseen risks.

ICT4D researchers are always in search of systematic guidance for addressing project challenges. As a result, a number of studies published by top journals in the ICT4D area, including *IT for Development* (e.g., Krauss, 2013; Krishna & Walsham, 2005; Madon, Reinhard, Roode, & Walsham, 2009; Walsham & Sahay, 2006, etc.), *IT and International Development* (Abraham, 2006; Anokwa et al., 2009; Medhi

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& Toyama, 2007, etc.), *Electronic Journal of Information Systems in Developing nations* (e.g., Touray, Salminen, & Murso, 2013), *International Journal of ICT and Human Development* (e.g., Mathur & Sharma, 2009; Rahman & Ramos, 2013), and books or book chapters (e.g., Chib & Harris, 2012; De, 2012; Krishna & Madon, 2003, Vaidya, Myers, & Gardner, 2013, etc.), discuss the challenges associated with ICT4D field research at great length. This multidisciplinary guidance available for conducting ICT4D field research equips researchers collecting, analyzing, and reporting data in multiple formats from the field.

However, this guidance is not systematic or structured. As a result, it requires significant experience or a relevant academic background for interpretation and application. For instance, a team of computer scientists (Brewer et al., 2006) advise researchers to "plan hard but remain flexible." But how does one remain flexible in ICT4D field research? What exactly does it mean to plan hard in the context of ICT4D projects in developing nations? Also, there hardly exists any theoretical foundation of the guidance for addressing ICT4D project challenges, which makes the problem worse for researchers with no prior experience or training.

This study proposes applying project management principles to address ICT4D project challenges. Project management is a scientifically designed approach for managing scope, time, cost, quality, human resources, communications, and risks related to a variety of projects. Table 1 presents seven project management principles (PMP) and related activities.

However, PMP, which are codified by standards, tools, and techniques, cannot be applied "as is" to address ICT4D project challenges since PMP rely extensively on assumptions of economic rationality. For instance, increasing profit margins and controlling cost factors are the two prime objectives of PMP, which are typically not the goals of ICT4D projects; scaling, sustainability, and benefiting disadvantaged communities without undesired outcomes are typically the goals of ICT4D projects. There are fundamental differences in some of the goals of PMP and ICT4D projects. Due to the differences in the business environment in developing and developed countries (Roztocki & Weistroffer, 2011), PMP grounded in the West cannot be applied "as is" in the developing world. Hence, it becomes necessary to customize PMP for addressing ICT4D project challenges.

This chapter addresses the following two research questions: (A) what are the factors responsible for ICT4D project challenges? And (B) how can PMP developed in the West be customized to address the challenges experienced by ICT4D projects in developing nations?

The next section synthesizes various ways to customize PMP for a variety of development projects aiming to create social, economic, and human development in developing nations. The following section presents study findings. The concluding section discusses key contributions, limitations, and implications of this study.

GUIDANCE TO CUSTOMIZE PMP IN DEVELOPING NATIONS

Typically, researchers serve as project managers for ICT4D projects. Hence, irrespective of their personality and training they should be able to manage seven dimensions of ICT4D projects in order to address project challenges. ICT4D researchers could learn from the following observations and advice for customizing PMP for development projects in developing nations.

The operating conditions in the developing world as characterized by contextual factors make traditional PMP in the developed world less appropriate and applicable (Blunt, 1992). These contextual

Table 1. Project management principles

Scope management	Scope planning	Documentation of how the project scope will be defined, verified, controlled, and how the work will be broken down in a structured way
	Scope definition	Defining a project statement useful for future decisions
	Creating a work breakdown structure	Subdividing project into smaller, more manageable components
	Scope verification	Formalizing acceptance of completed project deliverables
	Scope control	Controlling changes to the project scope
Time management	Activity definition	Identifying specific schedule activities
	Activity sequencing	Identifying and documenting dependencies among schedule activities
	Activity resource estimating	Estimating the type and quantities of resources required for each activity
	Activity duration estimating	Estimating the number of work periods needed to complete schedule activities
	Schedule development	Analyzing activity sequences, durations, resource requirements, and schedule constraints
	Schedule control	Controlling changes to the schedule
Cost management	Cost estimating	Developing an approximation of the costs of the resources needed to complete project activities
	Cost budgeting	Aggregating estimated costs of individual activities to establish cost baseline
	Cost control	Influencing factors creating cost variances and controlling cost changes
Quality management	Quality planning	Identifying quality standards relevant to the project and deciding how to satisfy them
	Perform quality assurance	Applying the planned systematic quality activity to ensure that the project employs processes necessary to meet requirements
	Perform quality control	Monitoring project results to make sure they comply with relevant quality standards and identifying ways to eliminate cases of unsatisfactory performance
Human resource management	Human resource planning	Identifying and documenting roles, responsibilities, and reporting relationships
	Acquire project team	Obtaining human resources
	Develop project team	Improving competencies and interaction of team members
	Manage project team	Tracking team member performance, providing feedback, resolving issues, and coordinating changes to enhance project performance
Communications management	Communications planning	Determining the information and communications needs of the project stakeholders
	Information distribution	Making needed information available to project stakeholders in a timely manner
	Performance reporting	Collecting and distributing performance information
	Manage stakeholders	Managing communications to satisfy the requirements of and resolve issues with project stakeholders
Risk management	Risk management planning	Deciding how to approach, plan, and execute the risk management activities
	Risk identification	Determining which risks might affect the project and documenting their characteristics
	Risk analysis	Prioritizing risks for subsequent analysis and assessing and combining the probability of occurrence and impact
	Risk response planning	Developing options and actions to enhance opportunities and to reduce threats to project objectives
	Risk monitoring and control	Tracking identified risks, monitoring current risks, identifying new risks, executing risk response plan, and evaluating their effectiveness throughout the project life cycle

Source: PMBOK, 2003

factors include geographic and cultural differences between project actors, technologically challenged operating conditions, and unpredictable socio-political environments. The challenges of managing a team of diverse stakeholders are exacerbated as a result of the varied political, cultural, and linguistic differences faced by development projects (Cleland & Ireland, 2008). In an ICT4D field research team, in addition to disadvantaged communities and local mediators, researchers may have to work with local technical support personnel, local gatekeepers, and government officials. It is necessary for researchers to identify and address the motives and agendas of various actors participating in field research so that various ICT4D project challenges can be managed appropriately.

To manage challenges in development projects in the developing world, the project management literature strongly advises considering the "need to cope with political and community demands on project resources, recognition that economic rationality and efficiency, assumed as a basis for many project management tools and techniques does not reflect local realities; and that use of such tools and techniques will not enhance project success if they run counter to cultural and work values" (Muriithi & Crawford, 2003, p. 309). A contemporary view of project management acknowledges the influence of culture on the management of project challenges (Shore & Cross, 2005; Wang & Liu, 2007).

Project managers are accountable for managing cultural factors affecting the success of projects. Most importantly, they need to be culturally sensitive, i.e., they should understand the mentality of others, but that can be achieved only if they understand their own mentality as it comes across to others (Hofstede, 1997). A project manager's ability to decode and encode messages when communicating with everyone involved in the project holding different beliefs grounded in varied national and organizational cultural values plays a critical role in managing challenges (Henderson, 2008). Biases of project managers affect their ability to manage and make decisions, leading to project failures (Shore, 2008). A project management study conducted by Yanwen (2012) illustrates how project managers could assess the project environment, maintain flexibility, and be competent to analyze the nature of associated problems in geographically dispersed projects. ICT4D researchers need to be sensitive and responsive to the various cultural factors and habits of the disadvantaged communities with whom they conduct field research.

METHODS

This study builds on an empirical base of 380 artifacts. The artifacts include journal articles, books, master's theses and doctoral dissertations, national and international conference proceedings, newspaper articles, and project reports submitted to grantees. The artifacts are authored by scholars from academia, public organizations (e.g., World Bank, Ford Foundation, and the Bill and Melinda Gates Foundation), and private companies (e.g., Yahoo and Microsoft Research). The artifacts can be categorized into empirical study findings, observations from ICT-prototype pilot studies, reviews of ICT designed for a particular disadvantaged community, and comparisons of ICT-based practices in developing nations.

Rationale for Selecting the Sources

The author commenced the study by compiling peer-reviewed articles published by top-tier ICT4D journals. Proceedings from conferences like ICT4D, ITU World Telecom Development Conference,

Mobile Communications for Development, and conferences held by IFIP, with acceptance rates of 40% or less also enriched the collection. In the second phase, a snowball sampling approach was adopted to access artifacts from a variety of journals (e.g., MIS Quarterly, IT and People, Communications of the ACM, etc.) in the disciplines related to and outside of ICT4D. On multiple occasions the EBSCO, ERIC, ProQuest Dissertations, and Google Scholar databases were used to retrieve academic artifacts other than journal articles. Search engines of public agencies/institutions and private sector firms including Google were instrumental in locating practitioner reports and non-academic artifacts published since 2000.

Data Analysis

The author analyzed 380 artifacts using cluster analysis technique and grounded theory principles.

Cluster Analysis: A Lens for Identifying and Depicting Factors Responsible for ICT4D Project Challenges. Cluster analysis is a data visualization technique used for depicting complex phenomena or describing the world for analyzing data (Tan, Steinbach & Kumar, 2006). Cluster analysis divides data objects into groups that are meaningful, useful, or both. Each cluster is a collection of objects that share common characteristics. The greater the similarity within a group and the greater the difference between groups, the better or more distinct the cluster becomes. Visual representation of clusters consists of the following methods: Conceptual, density-based, well-separated, prototype-based, and graph-based. This chapter employs graph-based cluster analysis where nodes are objects and links represent connections among objects. The graph-based visualization represents clusters as connected components.

Grounded theory is a method for conducting qualitative research originally conceptualized by sociologists Barney Glaser and Anselm Strauss (1967). The data analysis for this study is based upon the method as explained by Glaser and Strauss. The open coding, i.e. line-by-line coding, of more than 150 challenges documented within the 380 artifacts led to more than 50 axial codes that were further clustered into 7 select codes. For instance, the author recommends managing the scope of data collection based on two axial codes, namely, setting unrealistic goals for data collection and a lack of planning for data collection. The axial codes were derived from open codes such as: lack of time, money, and other context-specific resources, inflexible schedules for data collection, selection of research sites without maps or transportation, and uncoordinated data collection at multiple research sites in the same research project. In another instance, the author identified insufficient funds for data collection, abrupt discontinuation of funds during data collection, and sudden increases in the cost of hardware devices and other resources during data collection as some of the open codes which led him to propose the following three axial codes: insufficient operational budget, unreliable sources of funding, and unpredictable operational cost; the axial codes underscore the significance of managing cost during data collection.

Table 2 demonstrates the process of deriving seven clusters of challenges extracted from the ICT4D literature considered for analysis. The analysis of these challenges suggests that the inability of researchers to manage *scope, time, cost, quality, human resources, communication,* and *risks* related to data collection makes ICT4D field research challenging.

Table 2. Analyzing ICT4D project challenges

Open Coding Sample Data Points (Challenges)	Axial Coding Clustering of Challenges	Selective Coding
Lack of time, money, and other context-specific resources (e.g., appropriate housing, etc.) to complete ongoing data collection	Unrealistic goals set for data collection	Lack of scope management
Inflexible schedule for data collection		
Selecting research sites without maps or transportation, etc.	Lack of planning for data collection	
Uncoordinated efforts including data collection at multiple research sites of a single research project		
Too short or too long duration of data collection	Inappropriate duration of data collection	Lack of time management
Too many questions in a single survey or interview		
Collecting data during draught or monsoon	Wrong timing of data collection	
Insufficient funds negatively affecting the scope, duration, or any other factor related to data collection	Insufficient operational budget	Lack of cost management
Abrupt reduction or discontinuation of funding for data collection	Unreliable sources of funding	
Sudden increase in the cost of ICT during data collection	Unpredictable operational cost	
Incorrect data, data entry errors by local assistants or researchers, etc.	Poor quality of data	Lack of quality management
Ambiguous data collected by local assistants or researchers		
Noisy communication channels and interrupted communications	Poor communication channels	
Recruitment of assistants who are unable to communicate in a local dialect spoken by disadvantaged communities	Inappropriate composition of research team	Lack of human resources management
Sudden disappearance of local assistants from data collection sites, irresponsible behavior of researchers, etc.	Lack of accountability among team members	
Disadvantaged communities wary of talking to outsiders	Cultural and contextual barriers to communication	Lack of communication management
Lack of trust in ICT and trust in personnel involved in data collection		
Differences in researchers and disadvantaged communities creating misunderstandings, hostility, or other negative feelings	Demographic and social barriers to communication	
Flood, earthquake, wildfire, etc.	Unexpected natural calamities	Lack of risk management
Unwillingness of participants to share their personal stories related to sensitive, embarrassing, or controversial research topics	Sensitive, embarrassing, or controversial research topics	
Riots, political rallies, elections, epidemics, etc. during data collection	Changes in local circumstances	

FINDINGS

Six Factors Associated with ICT4D Project Challenges

Outside researchers, disadvantaged communities, local assistants, ICTs, contextual factors, and research methods are associated with the challenges, barriers, and issues facing ICT4D projects.

1. **Outside Researchers:** Cross-cultural working, adapting to local culture, and understanding the needs and customs of disadvantaged communities are the most frequent challenges faced by *outside researchers* (Blom, Chipchase & Lehikoinen, 2005; Walsham & Sahay, 2006). Visible dis-

parities between disadvantaged communities and researchers often lead to misunderstandings that could create suspicions regarding the researchers' intentions. Their assumptions, preconceptions, and limitations, including the inability to understand local concerns, needs, and realities create hurdles in their field projects (Krauss & Turpin, 2013). For instance, as part of a study conducted in Kenya, researchers brought expensive computers into a resource-starved community during a time of drought when the community was barely capable of producing enough food. This upset the community affecting their study participation (Hewett, Erulkar, & Mensch, 2004).

2. **Disadvantaged Communities:** Psychological, physical, cultural, and several other issues associated with *disadvantaged communities* negatively affect their interest and ability to participate in field research. For instance, Straub, Loch & Hill (2001) found that the cultural beliefs and values in Arab society are strong predictors of their resistance to new information and communication technologies. Disadvantaged communities often have to go through difficult cultural transitions to understand new or culturally-foreign ICT, and to interpret it within their community and context (Krauss, 2013). Detailed effort and attention to the involvement of multiple stakeholder groups play an important role for the successful implementation of ICT projects (Krishna & Walsham, 2005); failure to do so discourages potential study participants, diminishing the quality and quantity of responses. Lack of trust for ICTs or research teams often appears to be another core issue impeding the implementation of ICT4D projects (Vaidya et al., 2013). Sometimes community and political leaders pressure potential participants not to cooperate with outside researchers to demonstrate their "loyalty" toward the community (Hewett et al., 2004). Also, disadvantaged communities living in remote, thinly populated areas pose logistical and technical problems making data collection cumbersome (Elahi, 2008).
3. **Local Assistants:** Sometimes *local assistants* unintentionally create or are unable to help researchers solve ICT4D project problems. Their abrupt disappearance from research sites could create uncertainty for field research (Brewer et al., 2006). Violation of project protocol and data collection policies by local assistants affects the quality of data collected. For instance, local assistants, who were assigned to conduct face-to-face and self-administered interviews, went over an allocated time period in the hope that by conducting more in-depth interviews they would be looked on favorably for possible future employment (Hewett et al., 2004). Sometimes financial incentives are not lucrative enough for local assistants to continue working on field projects (Elahi, 2008). A lack or low degree of engagement from the IT industry with the transformative ICT4D discourse in developing nations fails to produce skilled IT workers with a passion to work for development programs (Avgerou, 2008). As a result, ICT4D projects are forced to utilize local assistants who lack technical expertise for addressing technical issues, stalling the projects.
4. **ICT:** Typical *ICT*-related issues including power outages and interruptions (Anokwa et al., 2009; Brewer et al., 2006), noisy communication channels, and the several unpredictable technological problems prevalent in developing nations creating hardware and software problems, delaying or interrupting the execution of ICT4D projects. The limited technical resources available for ICT4D projects inhibit the development and management of innovative information systems for developing nations (Avgerou, 2008).
5. **Contextual Factors:** Contextual factors frequently affect the following dimensions of ICT4D projects: information, technology, processes, objectives and values, staffing and skills, management systems and structures, and valuable project resources like time and money (Heeks, 2002). In addition, bureaucratic systems, government policies, organizational norms, and processes in

developing nations shape the research design for worse or delay the implementation of ICT4D projects (Krishna & Walsham, 2005). For instance, the government organizations implementing agricultural marketing information systems tend to be ridden with rigid bureaucracies, corruption and inefficient project management (Islam & Grönlund, 2010). Contextual problems like intermittent political interference, a lack of supporting policies crafted by organizations or governments, and deeply ingrained unfair local practices (Vaidya et al., 2013) also challenge the implementation of information systems in developing nations.

6. **Research Methods:** Data collection, an important dimension of *research methods*, is often affected severely by challenges, barriers, and issues associated with ICT4D projects. For instance, conservative social values and cultural norms made it difficult to get honest feedback from disadvantaged populations in Pakistan, Tanzania, Rwanda, and Ghana (Anokwa et al., 2009). In a similar experience, Evangelical Christian groups made it almost impossible for unmarried Kenyan adolescent boys and girls to participate in a survey seeking information about family planning and sexual behavior (Hewett et al., 2004). Conflicts among upper management, unions, and middle management make it difficult for collecting data from public servants working in government-funded organizations in developing nations (Tarafdar & Vaidya, 2005). Due to the official ban on recording interviews with government officers in India, Puri & Sahay (2007) could not tape their interviews with the officials as part of their research project studying the role of ICTs in participatory development in rural parts of the country. Intentional tampering with data by local IT staff and data theft are two more key threats affecting the quality of data in ICT4D projects (Brewer et al., 2006). Research questions like "what, how, why, and when people carry what they do" require device researchers to study the user in an everyday mobile environment. This type of data collection is particularly challenging when observing female mobile phone users in developing nations (Blom et al., 2005).

The above cluster analysis portrays the association of six factors (human and non-human) with challenges related to ICT4D projects. The factors, which are identified by the literature dedicated to ICT4D project problems, are as follows: ICTs, disadvantaged communities, outside researchers, local assistants, data collection, and contextual factors. Each cluster (see Figure 1) is labelled by the factor responsible for or associated with the challenges, barriers, and issues in the cluster.

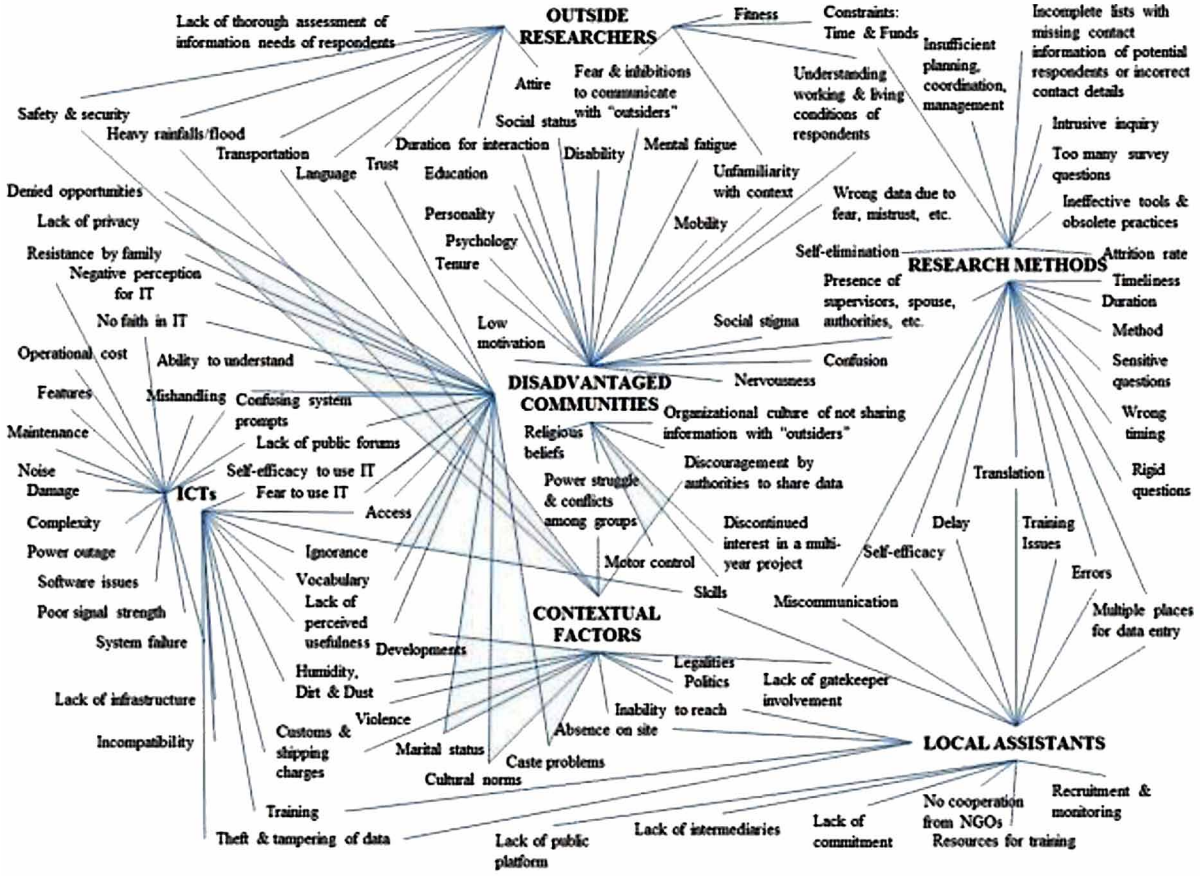
The cluster analysis also identifies the inter-relationship among six clusters. Several challenges, barriers, and issues are associated with one, two, or three factors at a time. For instance, "fear & inhibitions to communicate with outsiders" is related to two factors, namely, outside researchers and disadvantaged communities. A majority of challenges are associated with disadvantaged communities followed in order by information technologies, contextual factors, disadvantaged communities, outside researchers, and local assistants.

The next sub-section illustrates the ways to manage the seven dimensions drawn from the literature on ICT4D projects successful in addressing ICT4D project challenges in the past, the lessons learnt by researchers, and their advice for collection data from disadvantaged communities in developing nations.

Managing Seven Dimensions of ICT4D Projects

Considering the variation in contextual factors related to developing nations, it is important to remember that a successful practice in one context does not guarantee the same level of success in other contexts. Researchers may need to make appropriate changes to a practice successful in one context when applying

Figure 1. Visualizing ICT4D field research challenges



it to other contexts. Failures and shortcomings documented in past studies are helpful for understanding what not to do or how mistakes could be avoided during data collection.

The following sub-sections illustrate the utility of PMP for addressing ICT4D project challenges. It is important to note that a majority of the existing guidance for addressing ICT4D project challenges is similar or related to the literature on customizing PMP for development projects in developing nations. For instance, the lessons learnt and the guidance offered by experienced researchers (e.g., Braa, Monteiro & Sahay, 2004; Heeks & Bhatnagar, 1999; Heeks, 2009; Krishna & Walsham, 2005; Sahay & Walsham, 2006) for managing data collection efforts in ICT4D projects *overlap* with the PMP.

1. **Managing Scope of Data Collections:** While planning and defining the scope of data collection, past ICT4D studies advise to take into consideration contextual factors including socio-cultural inequalities and religious beliefs that could possibly threaten the execution of data collection (Braa et al., 2004; Walsham & Sahay, 2006). Researchers break down the scope of ambitious ICT4D projects into manageable objectives and deliverables for synchronous data collection at multiple sites. The Technology & Social Change Group at the University of Washington undertook a global study to learn the ways in which trust and perceptions shape uses of ICT at public access venues like libraries, telecentres, and cybercafés in 25 developing nations (Gomez & Gould, 2010). They

developed a shared research design to form local research teams and appoint team leaders to conduct surveys, visit over 500 sites, and interview over 25,000 respondents in different types of public access venues in the selected countries. The systematic planning and delegation of tasks and responsibilities to various teams allowed the Group to collect data synchronously and meet the objectives set for this ambitious research project. To facilitate synchronous data collection at different sites, multiple teams consisting of local gatekeepers were formed.

Periodic verification of the scope of data collection could help researchers manage the challenges associated with access to research sites and ICT. Poor transportation infrastructure makes it difficult for researchers to reach respondents living in remote rural parts of any developing country. For instance, Vodafone Research Team (Samuel, Shah, & Hadingham, 2005) found that roads to 11 communities and 9 businesses in Tanzanian villages were sealed. Considering the resources at hand, the researchers eliminated potential respondents from the inaccessible villages. In a similar instance, accessing and keeping track of nomadic respondents living in informal settlements posed a unique set of challenges for data collection. While collecting data from urban migrants in South Africa, Mathee et al. (2010) found that in informal settlements, maps were either not available or considerable change had occurred between the time of map production and the time of data collection. The researchers considered using aerial photographs to improve sampling accuracy, but the cost of commissioning dedicated aerial photography was prohibitively expensive. In such unexpected circumstances and with limited resources at hand, they decided to eliminate potential respondents from the inaccessible sites.

Researchers cannot address ICT4D project challenges alone; the involvement and cooperation of local assistants is critical for outside researchers to be able to address the pre-existing context-specific barriers and subsequent ICT4D project challenges.

2. **Time Management:** Appropriate timing and duration (i.e. not too short or long duration) of data collection is critical in shaping the interaction of researchers with disadvantaged communities. Aggressive ICT prototype development timelines often limit time spent by the HCI researchers in the field. For instance, the small amount of time that HCI researchers were able to spend in the field did not give them enough opportunities to understand local culture and possible ways in which their system would be adopted by locals in a developing nation (Chetty & Grinter, 2007). Long durations of collecting responses on sensitive personal and social issues could adversely impact data collection. For instance, semi- and low-literate users from Botswana experienced mental fatigue while revealing HIV/AIDS related health information (Sharma-Grover, Plauche, Barnard, & Kuun, 2009).

To address duration-related challenges, researchers advise others to identify, define, and prioritize data collection activities. They also advocate for estimating and utilizing the type and quantities of resources available to complete the activities (Chetty & Grinter, 2007; Sharma-Grover et al., 2009). Better informed decisions about data collection schedules can be made after gathering the information related to time durations, resource requirements, and schedule constraints.

Fifth grade students from government-run schools in India were expected to participate in an ICT-prototype testing experiment aimed at improving multi-user sharing of existing educational applications. However, the study was conducted during a swine flu scare in 2008. This issue, coupled with widespread absenteeism in government-run Indian schools, led to absence rates approaching 75% on specific days

of data collection (Heimerl, Vasudev, Buchanan, Parikh, & Brewer, 2010). Researchers cannot predict the natural or man-made calamities that might be faced by study participants; hence, to handle such unexpected challenges resulting from the *wrong timing* for data collection, researchers need to have contingency plans or a plan B for data collection (Heimerl et al., 2010). To address timing-lead ICT4D project challenges, it is advisable to undertake pilot studies to estimate appropriate timelines, durations, and the frequencies of data collection in ICT4D projects.

3. **Managing Costs of Data Collection:** The costs of one-time investments in ICT, recurring maintenance costs (e.g., electric bills, etc.) for devices supporting ICT, and ongoing operational expenses for recruiting skilled personnel could be three areas of financial investment in the data collection phase of ICT4D projects. The exorbitant cost for access to the Internet constrained monetary planning for a qualitative study which examined how professionals in Nairobi, Kenya, use ICT in their everyday lives (Wyche, Smyth, Chetty, Aoki, & Grinter, 2010). Large sampling requirements and longitudinal designs often incur high financial costs (Duncombe, 2011). Limited funding assigned for studying rural farmers in China prevented Wang & Chen (2010) from conducting large surveys with farmers and farm-workers in rural China.

Researchers can manage their scarce funds available for ICT4D projects by (a) estimating the costs of the resources needed to complete data collection activities, and (b) aggregating the estimated costs of individual activities to establish a cost baseline (Mathee et al., 2010; Wang & Chen, 2010; Wyche et al., 2010). This approach is likely to control changes to the budget for data collection. Careful planning of field activities for data collection can save monetary resources and help researchers address challenges arising from having limited funds available for completing data collection. For instance, if their budget is small, researchers should not plan to undertake massive quantitative surveys but conduct qualitative interviews or semi-structured surveys with quick turnarounds, producing presentable results acceptable to the ICT4D community; they might not able to produce valid statistical inferences but being able to capture the impact of ICT from the perspective of disadvantaged communities is always better than having small quantitative samples with inconclusive or limited causation (Duncombe, 2011).

4. **Quality Management:** Data quality is valuable to ICT4D projects since it may shape the ability of researchers to make sense of the expectations, needs, and experiences of disadvantaged communities using ICT solutions. Researchers advise managing decisions, activities, and external circumstances that deteriorate data quality. In a study observing parental perspectives on computers in rural India, unannounced visits by researchers at the respondents' homes were considered intrusive and unethical, straining the interactions between the researchers and the respondents (Pal, Lakshmanan, & Toyama, 2007). Tense interactions with participants could deteriorate the quality of information shared by study participants. Hence, researchers should avoid any such decision and action jeopardizing their relation with disadvantaged communities.

Researchers periodically monitor data collection results to decide whether the planned processes need to be adjusted for collecting the highest quality data. Sometimes it becomes difficult for respondents to answer certain questions in the presence of supervisors, spouses, or teachers if the responses are collected at workplaces, homes, or schools. For instance, the lack of privacy provided to Ghanaian HIV/AIDS patients adversely affected the quality of information shared by them in front of their families (Paik et

al., 2009). Kuriyan, Ray, & Toyama, (2008) warn researchers of not approaching disadvantaged communities as a way to get "the true story," but to understand their perspective for interpreting issues and possible solutions. This approach suggests researchers be empathetic with respondents and the context in which they respond to ICT and make use of ICT while pursuing their daily information needs.

The mere act of observing a group could influence the group's reaction to the observation, especially if the group is aware that they have been "chosen," which is also known as the *Hawthorne effect* (Adair, 1984). Paik et al. (2009) made a different arrangement to collect data from respondents in the absence of family members. Lima & Brown (2007) also observed that children and teens attending schools and colleges in Brazil were not comfortable participating in a study in the presence of their teachers. They changed their original data collection plan to make students comfortable sharing their stories in the absence of teachers. Thus researchers attuned data collection procedures to eliminate the causes of deteriorated quality of responses.

Datasets related to market prices for commodities, ICT adoption by disadvantaged communities, and small business owners are useful to jumpstart data collection in unfamiliar contexts. However, a lack of systematically collected historical data is a common problem when studying informal markets and unorganized communities. For instance, Abraham (2006) could not locate historical data on fish prices since few formal records were kept and many people hid or distorted any written records they did keep. In such circumstances, researchers must develop data quality standards and eliminate sources and data that do not meet the standards. To understand the impact of subsidies on the sustainability of tele-centers in Kyrgyzstan, it was essential to get hold of datasets on the low-income citizens receiving Internet coupons (Best, Thakur, & Kolko, 2009). However, incomplete lists with missing or incorrect contact information for beneficiaries forced the researchers to adopt convenience sampling which did not represent the entire population.

Without active participation and training of local assistants it is almost impossible for outside researchers to overcome language barriers, data entry errors, and the Hawthorne effect. Research methods should be designed in such a way that they respect the privacy of disadvantaged communities; it is necessary for researchers to learn local norms of privacy, etiquette, and decent behavior while working with disadvantaged communities, improving the likelihood of success in data collection.

5. **HR Management:** Local assistants, a key human resource for data collection, often play a multipurpose role in the data collection phase of ICT4D projects. For instance, they might be responsible for arranging transportation to research sites in remote rural parts of developing nations, introducing outside researchers to the gatekeepers of local communities, translating context and communications, conducting interviews with disadvantaged communities, addressing technology issues, helping researchers scale information systems, or catering to unexpected logistic requirements of data collection (Sahay & Walsham, 2006).

Due to their critical role in data collection, it is important that local assistants speak the same dialect and not just the same language as that of respondents. Researchers studying the speech-based access to health information by low-literate users in Pakistan assumed that local assistants would be able to speak the same language as that of the low-literate users. The researchers did not realize that health workers who could not speak Urdu would be of no use in collecting responses from the Sindhi speaking user population (Sherwani et al., 2007). The assumption made by outside researchers regarding local assis-

tants delayed the data collection process. Hence, it is important to involve local assistants, right from the beginning, i.e. the planning phase of data collection.

The shortage of local experts on software development, maintenance, and operation is a more long-term complicated problem than the difficulties associated with hardware purchases (Ewusi-Mensah, 2012). Many times locally recruited technical assistants fail to operate technology platforms or programming languages selected for software to be tested in the field. Sometimes local assistants flounder when asked to fix ICT. Also, many local assistants lack basic computing knowledge and of expertise in network administration. This means that each time the wireless network fails it stays down until a network administrator fixes it. To manage these issues, researchers must plan ahead of time for recruiting assistants with specific ICT skills required to collect data during ICT4D projects (Blom et al., 2005; Hewett et al., 2004). However, developing technology skills and expertise among local assistants requires a significant amount of training and education, which is generally out of the scope of ICT4D projects. Direct recruitment of undergraduate and graduate students in Western universities and residents of developing nations living in the West, who have the requisite technology expertise and skills (Ewusi-Mensah, 2012), is a possible solution to the shortage of ICT skills required for data collection.

For addressing HR related challenges, researchers should (a) identify and document roles, responsibilities, and reporting relationships for staff members, (b) improve the interaction of staff members to improve their performance in the field, and (c) track staff performance by providing feedback and coordinating changes to enhance their overall performance. Without cooperation of local assistants it is almost impossible for outside researchers to streamline their process of recruiting and retaining the local talent necessary for completing data collection.

6. **Managing Communication:** Non-verbal communication between researchers and disadvantaged communities is equally or perhaps more important than verbal communication in data collection. Socioeconomic and demographic differences between respondents and researchers reflected through researchers' attire, perfume, eyewear, etc. reinforce their outsider status, and could eventually distort the way respondents perceive the researchers. For instance, women from indigenous communities in remote, rural parts of Australia shied away from researchers due to their feeling of "shame" for talking to outsiders (McCallum & Papandrea, 2009). Trust in ICT and trust in personnel involved in data collection also shapes the involvement of disadvantaged communities in data collection. For instance, in a study with housemaids from urban India, perceived mistrust for technology led respondents to be hesitant towards touching the technology or to self-eliminate from the study (Medhi & Toyama, 2007). Sometimes researchers are being told what their respondents think the researchers want to hear, instead of being told the "real truth." In many cultures – and often exacerbated by the perceived power distances between researchers and locals – it is considered a courtesy to tell "guests" what they want to hear; it is rude to inform guests about real issues or problems. The locals are trying to please the researchers and want to support them in reaching their perceived research objectives.

Building a bond of trust with study participants is a major step toward addressing communication-related challenges for researchers. For instance, researchers can overcome the communication challenges by determining the information and communication needs of the disadvantaged communities with the help of local assistants, and making needed information available to them in a timely manner.

Sometimes when study participants do not trust the ability of ICT, it becomes necessary for researchers to convince the participants of the utility and benefits of using ICT for their betterment. If convinced, the disadvantaged communities are likely to participate actively in data collection exercises. Without active participation of local assistants it is almost impossible for outside researchers to gain the trust of disadvantaged communities, which in return, would help them portray a positive image to seek maximum possible cooperation from disadvantaged communities.

7. **Managing Inherent Risks:** When researchers test ICT prototypes with disadvantaged communities, there are some obvious risks associated with the experiments. Typical risks are related to the fear of, unfamiliarity with, or lack of efficacy of respondents for using ICT. A team of researchers testing a multimedia application for information dissemination in disadvantaged communities found that fear and inhibitions among respondents towards using the application kept the communities away from it (Chu et al., 2009). The nervous state of respondents towards using ICT discouraged respondents from participating in a project that tested the impact of touchtone vs. speech recognition on HIV health information access (Sharma-Grover et al., 2009). In a similar case, the negative perceptions of disadvantaged communities towards newly introduced ICT and their unfamiliarity with text-based technology discouraged them from participating in a study assessing the vulnerability of their communities after surviving disasters in rural Asia (Chib & Komathi, 2009). Researchers should never blame disadvantaged communities for their inability to operate ICT prototypes. Instead they should empathetically analyze the fear and any other psychological barriers that lead to the inability of study participants to use ICT, and should encourage the participants with the help of various incentives, including financial compensation.

Sensitive, embarrassing, or controversial research topics could jeopardize data collection. The social stigma associated with victims of HIV/AIDS often makes it difficult for data collection teams to reach out to the victims for data collection. For instance, Angolan patients were hesitant and reluctant to give personal information regarding their HIV/AIDS and sexual behavior (Cheng, Ernesto & Truong, 2008). Questions related to alcohol and drug consumption, contraceptive practices, pregnancies, induced abortions, and illegitimate child births cause a similar setback for data collection. Assuring the privacy of study participants during data collection and guaranteeing the confidentiality of data collected are common strategies for collecting data on sensitive, embarrassing, or controversial research topics (Cheng et al., 2008; Paik et al., 2009).

The issue of safety vs. the ability to operate on research sites is often faced during data collection. The safety of participants and research teams is paramount but each environment comes with its own set of risks. Mathee et al. (2010) experienced verbal abuse, racial slurs, and physical assault (or threats of it) while conducting interviews in South Africa. The risk of offensive behavior and physical assault was elevated over weekends when the consumption of alcohol and substance abuse were at a peak. Moreover, conflicts with local organizations could also result in high rates of crime, challenging the safety of research teams. It is always advisable to avoid collecting data in risky sociocultural environments.

Researchers should identify and determine which risks might affect their data collection and their staff members, and document the risk characteristics. Prioritizing risks based on the probability of their occurrence and impact is another strategy implemented during data collection. It is important to analyze the effect of identified risks on overall data collection objectives, developing options and actions

to reduce threats to data collection objectives, tracking and monitoring identified risks, and recognizing new risks and evaluating their effect on data collection.

FUTURE RESEARCH DIRECTIONS

This chapter breaks silos between the ICT4D and project management communities, ushering in a new era where both communities could engage to benefit each other and disadvantaged communities in developing nations. The ICT4D community could learn from the applications of PMP for managing projects in developing nations. For instance, the project management literature advises managers to (a) assess and adapt to local realities, cultural values, organizational norms, and work practices (Nguyen, 2007), (b) revitalize the sluggish and ineffective management practices in organizations (Stuckenbruck & Zomorrodian, 1987), and (c) acquire and retain skilled IT professionals in developing nations (Mia & Ramage, 2011).

PMP could help researchers adopt innovative process-based and technology-driven solutions to collect, store, and process different types of data (i.e. text, audio, video, tactile, etc.). Research focusing on the inter-relationship between contextual factors (e.g., policy frameworks, environmental conditions, culture, etc.), research methods, and local assistants in ICT4D field research could enrich this dialog between ICT4D researchers and project management professionals.

The project management community could undertake consulting assignments with the World Bank, United Nations, etc. to help them conceptualize, plan, execute, and report findings from ICT4D projects with disadvantaged communities in developing nations, thereby increasing the success rates of ICT4D projects and possibly saving millions of dollars' worth of donations and taxpayer money.

Finally, the visualization of ICT4D project challenges depicted in this chapter would help the ICT4D community to (a) synthesize a wide variety of ICT4D project challenges at one place (similar to a snapshot), (b) identify trends, indirect relationships, or hidden patterns among the challenges, which might not be possible otherwise in the text format, and (c) analyze new challenges, which are not depicted in figure 1, by correlating the new challenges with one or more of the six factors in order to devise a solution.

CONCLUSION

Success stories, failures, and shortcomings in projects documented in past ICT4D studies suggest a strong correlation between the management of the seven dimensions of ICT4D projects listed above and the ability to address project challenges. For instance, researchers who broke down the scope of ambitious data collection conducted at multiple sites in different developing nations were successful in collecting data synchronously with the help of teams of local assistants (Gomez & Gould, 2010; Samuel et al., 2005). These examples and similar others illustrated in this chapter support the author's claim regarding managing the seven dimensions to address ICT4D project challenges.

Some of the key contributions made by this chapter are as follows.

1. This chapter informs researchers by providing an argument in terms of how to think about and address ICT4D project challenges. Key areas of interest for researchers covered in the chapter include challenges in eliciting participation, gathering data, and working with participants in developing

nations. Exploring possible ways of managing the seven dimensions associated with data collection provides a greater learning experience for researchers.

2. The overall guidance to manage the seven dimensions is based on past ICT4D studies. The studies included both failures and successful case examples. Considering the differences in contextual factors in developing nations, this chapter asks researchers to make appropriate modifications in the ways they manage the seven dimensions as illustrated by the past studies successful in addressing ICT4D project challenges.
3. The existing ICT4D literature rarely offers any structured guidance to conduct field research with disadvantaged communities in developing nations. This chapter fills the gap by illustrating the utility of PMP for addressing project challenges. The generalizability of these dimensions would be of immense value to ICT4D researchers in the future.

Limitation

The challenges discussed in this chapter are reported by academic researchers, who may have very different motivations and resources to address the challenges than that of practitioners. Hence, practitioners may not find the study findings useful or applicable. Also, this chapter does not present a comprehensive list of challenges, but it proposes ways to address a large number of ICT4D project challenges rarely documented and analyzed in a single artifact.

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KEY TRENDS AND DEFINITIONS

Culture: Culture can be defined as the values and belief systems held by a group of individuals, learned early in life, and difficult to change (Hofstede, 1997).

Development: Human development can be defined as "a process of enlarging people's choices" (UNDP, 1990, p.10).

Project: The project management literature defines the term project as an endeavor undertaken to create a unique product, service, or result. Ideally, every project has a definite beginning and a definite end (PMBOK, 2003).