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INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING
AND
UNIVERSITY OF PRETORIA

PROCEEDINGS OF

IFIP WG 9.4-University of Pretoria Joint Workshop

Theme: Towards an ICT Research Agenda for African Development

23-24 September 2008

at the

UNIVERSITY OF PRETORIA, SOUTH AFRICA

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Proceedings of IFIP WG 9.4-University of Pretoria Joint Workshop
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Assessing the quality of the ‘TurnStormer’ thinkLet as a Collaboration Engineering building block for the Implementation of the Promotion of Administrative Justice Act of South Africa

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ABSTRACT

This paper assesses the quality of the TurnStormer thinkLet as a building block for Collaboration Engineering for the Implementation of the Administrative Justice Act of South Africa. Although a complete research paper on its own, it constitutes a milestone in an ongoing exploratory study that commenced in 2005 and is to end in 2010. An assessment framework of the study as a whole was declared at its outset as being guided by the critical appraisal guidelines developed by Atkins and Sampson. However, the creation of the first thinkLet of the study in 2006, the TurnStormer thinkLet, required that it be assessed following some Collaboration Engineering design standards. Such standards were not available yet in the literature, but a completed doctoral study by Kolfschoten in December 2007 crystallised them and they are used in this paper to assess the quality of the designed TurnStormer ThinkLet as a Collaboration Engineering building block. The analysis shows that the TurnStormer thinkLet meets four of the five dimensions of quality of collaboration process design for Collaboration Engineering.

INTRODUCTION

The ubiquity of the Internet and the associated web-based Information and Communication Technologies enabled by it, continue to prompt Scientists, Engineers and Technologists to experiment with the potential use of computer-based support systems in areas previously unimagined. Who would have thought that anyone could have imagined a computer-based modelling and simulation of the implementation of an Act of Parliament within a South African e-Government context? For different reasons, such efforts could easily have been dismissed at the outset by both the Information Systems and the legal fraternities.

The requirements of South Africa's Promotion of Administrative Justice Act - PAJA (Act 3 of 2000) and the Government's Batho Pele policy directive that put the interests of the people of South Africa first, provided us with an opportunity for initiating a research project whose design involves the creation of a Collaboration Engineering simulation framework in support of the implementation of the PAJA. In terms of this Act, South Africans have a constitutional

right to lawful, reasonable and procedurally fair administrative action, and to the right to be given reasons for administrative action. The Act sets out procedures that government officials must follow before and after taking a decision. The procedure applies to all organs of the state. These procedures, together with the rubrics thereof are documented in the Code of Good Administrative Conduct.

The rubrics of the PAJA align closely with decision support systems in computer science, operations research and information systems. The research and experimentation reported on in this study is conducted within the Informatics research discipline, specifically within decision theory and group decision-support systems. In this research, our aim is to explore innovative ways in which web-based Group Support Systems (GSS) tools could be used to enable ordinary South African citizens to effectively engage between themselves, government administrators and managers as required by the PAJA. The study also aims to identify and harness opportunities for sustained collaboration and interaction by communities who would use web-based GSS tools within the e-government context in South Africa.

To support innovative engagement, sustained collaboration and effective interaction, Collaboration Engineering through the notion of a thinkLet and participation in their creation and packaging is adopted and used. In 2006, the first thinkLet was created from three simulation exercises that we conducted as part of our ongoing Action Research study. It is the quality assessment of this thinkLet, the TurnStormer thinkLet that this paper seeks to address. A completed doctoral study by Kolfshoten in December 2007 crystallised standards which we use to assess the quality of the designed TurnStormer ThinkLet as a Collaboration Engineering building block. While this paper focused only on the assessment of the quality of the designed thinkLet, the study as a whole seeks to address the following main research question:

"What features are needed in web-based collaboration tools and how should interfaces be designed to enable citizens to interact effectively with government and public bodies in South Africa?"

The study is currently in its fourth year of a six years life span and is partially funded by the National Research Foundation, with several post-graduate students and co-investigators researching different topics. The study has received support from participants, municipalities and organisations from four provinces in South Africa, namely Northwest, Mpumalanga, Limpopo and Gauteng.

In positioning this paper within the goals of IFIP Workgroup 9.4 and the field of Information Systems, a brief discourse is necessary. Although it could be argued that the field of Information Systems has reached its maturity as a discipline, one could equally argue that, it by and large, still exists in a state of a "fragmented adhocracy" (Banville and Landry, 1989; Hirschheim and Klein, 2003, p. 237). This means:

That research in information systems is rather personal and weakly coordinated in the field as a whole; a researcher can gain a reputation by contributing in a way that is largely specific to a group of colleagues or a research site; a field is largely open to an educated public and amateurs can affect the field's standards; barriers to entry in the field are weak and going from one fragment to another is quite easy; reputations are fairly fluid, control of resources is unstable, conditions are likely to be ephemeral and leadership is often of charismatic nature; common-sense languages dominate the communication system

For this reason, there is a need for us to clearly distinguish the focus of this paper from mainline IS research and practice. Consistent with the goals of IFIP Workgroup 9.4, the research focus reported on in this paper is inclined towards the social study of the application of Information Systems within society in a developing country. In particular, the research is aimed at acquiring a better understanding of how effective government-citizen interactions could best be enabled through effective ICT use, and where possible and appropriate, identify or develop such ICT tools to facilitate the process. It is thus an Action Research study conducted within a Collaboration Engineering research framework. We recognise that Collaboration Engineering literature and approach may not be readily available to mainstream IS researchers and we provide some background in the paper to compensate for this. We adopt the view of an Information Systems as a socio-technical system developed by people for people (Du Plooy, 2003). This view stands in direct contrast with the traditional notion of Information Systems as a technological artifact which is conceptualised through to development between five stakeholder groups; the systems analyst, the system owner, the system user, the systems designer and the systems developers.

The rest of this paper is organised as follows: the next section gives a very brief background on Collaboration Engineering, followed by a presentation on thinkLets as building blocks for collaboration engineering. A detailed description of the emergence of the TurnStormer thinkLet from simulation exercises is given, followed by a presentation of collaboration process quality dimensions (Kolfschoten, 2007) used to assess the quality of the designed TurnStormer thinkLet. The significance of the study is highlighted, after which a concluding discussion ends the paper.

ABRIEF BACKGROUND ON COLLABORATION ENGINEERING

Collaboration Engineering (CE) is a novel approach to electronic collaboration whereby the facilitation of collaboration efforts is packaged into computer-based applications which are transferable, repeatable and predictable, and can easily be adopted and used by practitioners in their local context (Briggs et al., 2003).

Briggs et al (2003) put forward that for there to be successful CE efforts, there are three critical requirements; a low technology related skills conceptual load (easy computer steps to follow); the technology related facilitation skills need to be packaged such that different practitioners using the same packaging will get similar predictable results from their groups; the technology facilitation skills blocks must be packaged such that they can be reused easily to create a new collaborative process by re-organizing the package blocks. They then recommend thinkLets as the necessary building blocks for CE.

THINKLETS AS BUILDING BLOCKS FOR COLLABORATION ENGINEERING

Briggs et al (2003) define *a thinkLet* as:

“The smallest unit of intellectual capital required to create one repeatable, predictable pattern of collaboration among people working toward a goal” (pg. 46).

A thinkLet, according to the authors consists of three parts; a collaboration tool, the tool configuration and a script with step by step instructions on how to run it. The collaboration tool can range from a piece of paper to a technology that enables people to engage with each other collaboratively. When considered in this manner, it can be realised that Collaboration

Engineering is not bound to prescriptive technology tools. Certain types of collaboration tools though; such as Group Support Systems, enhance collaboration efforts. The tool configuration describes the way in which the tool is setup to allow the group to achieve its group goal. In creating a thinkLet, there is a need to know the required group goal so as to develop an appropriate tool configuration. Briggs et al. (2003) adopt and define five general group goals which they label as collaboration patterns. These collaboration patterns are; diverge - the group moves from fewer to more concepts; converge – from many concepts to focusing on a few worthy of further attention; organize – from less understanding to more understanding of the relationships among the concepts; evaluate – from less to more understanding of the possible consequences of each concept; build consensus – from having less to having more agreement on courses of action. The script is a detailed easy to follow description of the step by step instructions to enable the group to move towards its goals. Besides the conceptual support for predictability and reusability, thinkLets are the building blocks for Collaboration Engineering design and transfer (Kolfshoten, 2007:164).

The next section is dedicated to a description of how the TurnStormer thinkLet emerged from the three simulation exercises that we conducted as part of our ongoing Action Research study.

THE EMERGENCE OF THE TURNSTORMER THINKLET FROM THREE SIMULATION EXERCISES

The TurnStormer thinkLet, shown in Figure 1 below, emerged from a series of simulation exercises conducted as part of a field study (Twinomurinzi & Phahlamohlaka, 2006). The description of the field study and how the TurnStormer thinkLet emerged is detailed in the last reference which is readily available. In this paper, we will only briefly describe the process. As shown in Figure 1, the ideal

The TurnStormer thinkLet

Tool:

1. GroupSystems Categorizer

Configuration:

1. Create the two groups in Categorizer, the affected individual and the administrator
2. Display the Categorizer tool for both groups

Script:

1. *Say this to the affected individual:*
 - a. “You have read the scenario and the rejection letter, with your knowledge of the AJA, “Grace” how would you respond to the Administrator?”
 - b. Type in your thoughts on the computer. Do not send them as yet. While one person types, let the others engage in discussion.
 - c. You have 10 minutes to complete this task
 - d. Now submit your questions to your corresponding Administrator. “Grace” 1 to Administrator 1, “Grace” 2 to Administrator 2 ... “Grace” *n* to Administrator *n*.”
2. *Say this to the Administrator:*
 - a. “You have read the request from “Grace” as well as the rejection letter you sent to her, with your knowledge of the AJA and from the Administrator point of view, how would you formulate a response to “Grace”?”
 - b. Check that the application from “Grace” complied with the criteria for a Child Support Grant.
 - c. Wherever you find a point to note which might be of importance to “Grace”, make a note of it
 - d. You have 5 minutes for this exercise
 - e. Check that you followed the criteria for procedural fairness according to the AJA
 - f. Wherever you find a point to note which might be of importance to “Grace”, make a note of it
 - g. You have 5 minutes for this exercise
 - h. Discuss the notes you have raised and write a response to “Grace”.
 - i. Type out the response. Do not send it.

Figure 1: The TurnStormer thinkLet (Twinomurinzi & Phahlamohlaka, 2006, p. 9)

progression of engagement between an affected citizen and an administrator is simulated using a real case. This collaboration tool used to enhance the engagement is a Group Support System (GroupSystems®). The field study hence follows an Action Research method since the simulation involves the awareness raising and training of participants in the use of Information and Communication Technology.

The ideal progression of engagement to resolve an administrative action as required in PAJA is identical in all the research sites. The process is briefly described here. At the research site, the research participants volunteer whether to be an affected person or an administrator and are divided into groups of five where each group represents either an administrator or an affected person. The script is then meticulously followed. Because of time, the number of interaction cycles is limited to an hour. At the end of the engagements, we elicited feedback from three sessions. The first session has a researcher facilitating a group discussion to elicit the experiences of the research participants. In the second session, the research participants record their experiences privately and individually. In the final session, the research participants are asked to openly offer their opinions and observations within the context of the

day on anything they wish to comment on. This is also a facilitated discussion and takes the form of an open debate. It should be noted that all the research participants formally consent to the research.

Because the interpretive tradition is followed and we use an Action Research method, we are aware of the unavoidable bias since the study is designed to raise awareness and to provide training on the PAJA. The criteria of the analysis were also based on the notion of a thinkLet. The researchers were fortunate in that the independent researcher was one of the inventors of the thinkLet concept.

Having succeeded in creating the TurnStormer thinkLet, the logical question to ask is how can we assess its quality in line with the Collaboration Engineering design standards developed by Kolfshoten as pointed out in the introduction? How do we know that this thinkLet meets quality standards of a good collaboration process design for PAJA implementation? The next section is dedicated to addressing this question.

COLLABORATION PROCESS QUALITY DIMENSIONS: AN ASSESSMENT OF THE QUALITY OF THE DESIGNED TURNSTORMER THINKLET

Background on the quality of collaboration process design for Collaboration Engineering

Kolfshoten (2007) describes quality of collaboration as having a *process* and a *result* component and defines it as *appreciation of joint effort by relevant stakeholders*. In order for a collaboration process to be successful, the group members need to participate. There is a need to distinguish between quality of collaboration and the quality of a collaboration process design for Collaboration Engineering. The later is defined as the degree to which the Collaboration Engineering design supports a practitioner to support the group in achieving its goal. The concepts is strengthened by adding that group members do not just participate, make effort towards the goal; but that they also spend other resources to the process such as time, effort, knowledge and physical resources (Kolfshoten, 2007:32).

“These dimensions may at times be conflicting or incompatible. For instance, if the outcome of a collaboration owner can be very pleased with the results of a session, while the participants did not feel that all their interests were taken into account. Quality thus can be measured from different perspectives, and it varies based on the goal of the process and the intentions of the stakeholders with respect to the results” Kolfshoten (2007:32).

Kolfschoten (2007) developed five quality dimensions for describing quality of a collaboration process but she indicates that there is no independent objective quality measure for collaboration processes.

The support of high quality collaboration process design for Collaboration Engineering could be enhanced by good conceptualization of sets of thinkLets as they support both the design and transfer of collaboration processes.

Table 1: Quality dimensions of a collaboration design process to assess the design quality of the TurnStormer ThinkLet

Dimension	Dimension Description	Applicability to TurnStormer
Efficaciousness	<i>The extent to which the design, when used as prescribed will focus the expense of resources to achieve the group goal.</i>	The TurnStormer appears to us to be the master thinkLet that could guide the creation of smaller thinkLets each addressing specific features of the PAJA. However in comparing the TurnStormer with the master thinkLet conceptualization developed by Kolfshoten, it does not seem to be well conceptualized
Acceptance	<i>The extent to which the design when used as prescribed accommodates individual stakes sufficiently, to motivate stakeholders to commit the required resources for goal achievement.</i>	The TurnStormer thinkLet emerged out of designed collaboration process with active involvement of stakeholders. The taking of turns between the affected individual and Administrator in their engagement as required by the PAJA afforded them sufficient stakes. The fact they are all still participating in the workshops is a good indicator of commitment towards achieving the goal
Reusability	<i>The extent to which the design can be used successfully in different instances of the task</i>	We claim that the TurnStormer thinkLet is perfectly suited for reusability. Its design is made up very simple turn taking by the intended stakeholders. It captures the process flow that could be used to guide the different features of the PAJA process
Predictability	<i>The extent to which the design, when used as prescribed, creates a process and results as intended by the collaboration engineer.</i>	The processes as well as the results as intended by ourselves as the facilitators were in accordance with expectations.
Transferability:	<i>The 'ease of training' and the 'ease of execution' from the perspective of the practitioner</i>	
Ease of training	<i>The ease of training is determined by the training load: Training load is the amount of cognitive effort required from the practitioner to sufficiently understand the process prescription.</i>	We have enough evidence of practitioners expressing a level of understanding of the process. This has being demonstrated through the three simulation field studies conducted in 2006. This led us to think that the design of the TurnStormer thinkLet has reduced load on participants' cognition.
Ease of execution	<i>The ease of execution is determined by the execution load: Execution load is the amount of cognitive effort required from the practitioner to execute the process prescription</i>	We think that the designed thinkLet will be easily executable by the practitioners without much involvement of the collaboration engineer. This however must still be tested in the next field exercises in 2008.

Table 1 contains a bird eye view of our assessment of the TurnStormer thinkLet in accordance with the five quality dimensions. The detailed analysis thereof is presented in the next section.

Using the quality dimensions of a collaboration design process to assess the design quality of the TurnStormer ThinkLet

Efficaciousness: *The extent to which the design, when used as prescribed will focus the expense of resources to achieve the group goal.*

The TurnStormer appears to us to be the master thinkLet that could guide the creation smaller thinkLets each addressing specific features of the PAJA. However in comparing the TurnStormer with the master thinkLet conceptualization developed by Kolfshoten, it does not seem to be well conceptualized. Although it has components that could be mapped onto the master thinkLet UML class conceptualization developed by Kolfshoten, some work still needs to be done to achieve this. We know that the thinkLet design as presented does enable the group to engage in a process in accordance with the PAJA requirements, at least in a simulated environment, but probably not as efficacious as it could be.

Acceptance: *The extent to which the design when used as prescribed accommodates individual stakes sufficiently, to motivate stakeholders to commit the required resources for goal achievement.*

The TurnStormer thinkLet emerged out of designed collaboration process with active involvement of stakeholders. The taking of turns between the affected individual and the Administrator in their engagement as required by the PAJA afforded them sufficient stakes. The fact that they are all still participating in the workshops is a good indicator of commitment towards achieving the goal. The surfacing of specific cases in which practitioners play a role in assisting other members of the communities from which they come serves as indication of accommodated stakes, commitment of their own time resources as well as a source of motivation for their ongoing participation in the research project.

Reusability: *The extent to which the design can be used successfully in different instances of the task*

We claim that the TurnStormer thinkLet is perfectly suited for reusability. Its design is made up of very simple turn taking by the intended stakeholders. It captures the process flow that could be used to guide the different features of the PAJA process. In fact it emerged out of successful use in different instances of the task. For example field studies are conducted at different places using different cases. Also, in one of the field exercises in Lebotloane, GroupSystems could not function properly on the intranet and we immediately switched to Microsoft Word as a technology tool and achieved the same results as we would have using Categorizer tool in GroupSystems. The process that the TurnStormer thinkLet creates is reusable and sufficiently and sufficiently independent of the tool used.

Predictability: *The extent to which the design, when used as prescribed, creates a process and results as intended by the collaboration engineer.*

The processes as well as the results as intended by ourselves as the facilitators were in accordance with expectations. The design was intended for awareness raising and training so that the practitioners of and understands the PAJA process that it prescribes. The turn taking in roles as prescribed by the TurnStormer thinkLet design produces what we intended.

Transferability: *The 'ease of training' and the 'ease of execution' from the perspective of the practitioner*

Ease of training: *The ease of training is determined by the training load:*

Training load is the amount of cognitive effort required from the practitioner to sufficiently understand the process prescription.

We have enough evidence of practitioners expressing a level of understanding of the process. This has been demonstrated through the three simulation field studies conducted in 2006. This led us to think that the design of the TurnStormer thinkLet has reduced load on participants' cognition. It does appear to us that the design of the TurnStormer is parsimonious and thus substantially reduces its complexity. Coupled with the schemata prescribed by the PAJA itself, the TurnStormer thinkLet process seem to be easy to follow.

Ease of execution: *The ease of execution is determined by the execution load: Execution load is the amount of cognitive effort required from the practitioner to execute the process prescription*

We think that the designed thinkLet will be easily executable by the practitioners without much involvement of the collaboration engineer. This however must still be tested in the next field exercises in 2008. We will carefully monitor, observe and document the behaviour of the group following instructions as prescribed by the TurnStormer with a view to refining to refining them for increased parsimony.

In short then, the TurnStormer thinkLet fulfils four of the five quality dimensions of a collaboration design process. In work going ahead in the next two years, more attention will be paid to addressing the efficaciousness quality dimension while at the same time refining it to improve its fulfillment of the other quality dimensions.

THE SIGNIFICANCE OF THE STUDY

In order to underline the relevance and the importance of this study, one needs only look at the 2006 State of the Public Service Report of the South African Government. In this report, the public Service Commission refers nineteen times to the importance of the PAJA and identifies it together with the Promotion of Access to Information Act No. 2 of 2000 (PAIA) as the cornerstones of good governance and transparency. The report points out that despite this, the Public Service is as yet to abide by the Act, indicating that work still needs to be done to enable the Public Service to comply. The Act requires departments to have mechanisms for explaining administrative action and redress where necessary. It requires public officials to understand what constitutes lawful administration and what does not.

According to the report, the capacity to establish mechanisms for explaining administrative actions and redress as envisaged in the PAJA is totally lacking in the public service. The report contents that Departments that cannot provide reasons for their administrative actions and comply with the provisions of the Act are less likely to conduct themselves in a manner that is fair and impartial, and argues that at a management level, most decisions should comply with the requirements of PAJA. Of interest to us is an observation in the report that it would have been easier if decisions were plotted against the procedures for PAJA as gaps and deviations would be easily identified.

The report concludes with a warning message which underlines the importance of compliance:

“Paralegal organisations have used the provisions of PAIA and PAJA to compel departments to provide information, notably around the non-provision of social grants. Such pressure has resulted in court orders against departments and has helped to improve their performance. Should the frustration of civil society and paralegal organisations over non-compliance with these two Acts mount and lead to legal action, this could cost the government financial resources.”

In supporting the implementation of the PAJA through Collaboration Engineering simulation framework and thinkLets, our aim is to show people that computer-based technology can help in these processes.

CONCLUDING DISCUSSION

While we have not yet reached the point where we could describe with confidence all the features that are needed in web-based collaboration tools and how the interfaces could be designed to enable citizens to interact effectively with government and public bodies in South Africa; progress as presented in this paper indicates that we will eventually achieve this aim. The creation of the TurnStormer thinkLet makes us believe that a mechanism of doing this research on a larger scale, using a repeatable and predictable process that has the potential to be transferred to the participating communities and government departments to run on their own, following the principles of collaboration engineering has been found. It is possible that the various thinkLets that are expected to emerge from the subsequent simulations could be automated and used within a web environment in support of the PAJA implementation.

In an exploratory study such as this where you want to demonstrate the value of technology, there can't be a better way than through simulation and the TurnStormer thinkLet provides the framework within which further simulation exercises could be conducted

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Best Data Administration Practices for Data Migration: A Literature Study in the Healthcare Industry

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Abstract

This paper investigates the most practical and effective data administration concepts in order to improve data migrations, especially in healthcare systems. Currently healthcare is experiencing an increase in heterogeneous environments due to new mergers and acquisitions. One of the main concerns is identifying similar data between different systems during migrations. This leads to project scopes being exceeded because of a lack of effective data administration practices. The aim of this article is to explore best practices for migrating data and to structure this into a basic framework so that it can be adapted to almost any IT environment. Best practices identified include data modelling, data cleansing and information repository. The framework is further applied to a medical aid administrator case to demonstrate its ease of use. The results from the case prove that our framework is both simple and effective in its application, optimising on time and effort for current and future projects.

Keywords: *Data Administration; Migration; Data Model; Data Cleansing; Repository*

1. Introduction

Healthcare data and systems are rapidly evolving to cater for the ever changing needs of patients. Sensitive data such as diagnosis codes (ICD10 codes), specific disease treatments, price codes (tariffs and nappies) and new patient data need to be managed more carefully in order to ensure that these needs are met (Niland, Rouse and Stahl, 2006). One area of prime concern where the management of data plays a pivotal role is when data is migrated from one system to another, which is usually from a legacy system to a new IT system. The process of migrating data often fails or exceeds the project scope due to an organisation lacking in proper data administration principles. Basic guidelines and strategies such as a system architecture is often overlooked and the fact that it could serve as a lifelong easy-to-use integration tool for new business processes and decisions, amongst many other benefits, is hardly ever realised (Zviran and Glezer, 2000). This article attempts to establish most common best practice methods that can be used to improve data management, especially with data migration across healthcare systems. Concepts and primary issues within these methods will be discussed on higher level and mainly focus on Enterprise Data Modelling (EDM), Data Cleansing and Information Repository. A great deal of research has already been carried out in this area of study but has failed to be broadly recognised as an essential part to organization policy (Mullins, 2002). The aim of this article will therefore be to undertake a slightly different approach where all the above

concepts will be incorporated and structured into framework under a data administration style in hope that it might be acknowledged for what it is worth.

The rest of the paper is organised as follows. In section 2 we consider a methodology using a case study environment. In section 3 we look at data administration in general as well as its place in Healthcare in order to derive key best practices. This is then further investigated by relating it to data migration issues. Section 3 is then concluded with a proposed framework that incorporates the key steps identified in a structured manner. The framework is then applied to our case in section 4. In section 5 we draw up our conclusions by highlighting our main contributions and what we hope to achieve from this study. We finally end off in section 6 where we discuss the limitations of our study as well as make recommendations for future research.

2. Research methodology

Best practice methods for administering data will firstly be identified by means of a literature study where pertinent issues will be discussed and incorporated into a framework. In order to identify best practice data administration solutions that are realistic and practical we will look at a real-life environment of a medical aid administrator IT (assessing) system. Here we will attempt to map findings from our research, in the form of a framework, to that of our medical aid environment with the intent of improving areas of concern and to better explain our framework. As mentioned these methods will be viewed on a higher level where we will attempt to demonstrate the most important functions that are required to migrate and manage data efficiently.

3. Literature Review

3.1 Data Administration

Data administration covers a broad category of strategies and methods that is used to manage and maintain data effectively (Tolk, 2003). To name a few is data modelling, data cleansing, data sharing and data warehousing. Tolk (2003) defines data administration as the process of managing information and data that is exchanged within a group of systems including its documentation, format and integrity. Mullins (2002) on the other hand defines data administration as a process of understanding a business environment and being able to transform that into a logical model. The definition used by both TechEncyclopedia and ZDNet's Dictionary state that data administration is:

“The analysis, classification and maintenance of an organizations data and data relationships. It includes the development of data models and data dictionaries, which combine with the transaction volume, are the raw materials for database design.”

By viewing the above definitions, especially considering Tolk’s (2003) definition we can see that the various methods involved in data administration are more than appropriate for facilitating data migration from one system to another.

The job of data administration would typically be allocated to a data administrator (DA). If a DA is not appointed then the Database administrator (DBA) would have to assume this role, additional to his/her own duties (Tolk, 2003). After defining data administration, Tolk (2003) further went on to say that the objectives of a data administrator is to know what type of data is being used, its location, meaning, context as well as the required format that it is to be transformed to so that it can be successfully integrated with the new systems. Focusing more on an enterprise level, Smith (1997) explained a DA’s objectives to include the planning, documenting, managing and controlling of an organisations information resources with the main objective being to integrate and manage corporate-wide information resources. The fact that these processes are used to accommodate new integrated environments and ensure that data is successfully integrated and managed at all levels once again confirms the importance of data administration in the migration of data. Smith (1997) further explains a DA to have the roles and responsibilities of:

- Gathering and analysing business requirements
- Modelling the requirements
- Setting standards to improve data quality and integrity
- Encouraging and managing information repository resources

Similar functions that fall part of best practices have also been cited in (Burns, 2006) where to mention a few: a projects needs must be established in order to remove any misunderstandings between the involved stakeholders; the logical design of these requirements needs to be developed; data security and integrity needs to be enforced; continuous communication needs to be established through a information repository both during and after implementation. Other views and best practice recommendations made by Burns (2006) is to try and automate processes as much as possible in order to cut on time constraints and ease future developments. He also strongly suggests that information

and experience always be promoted and shared in order to educate people. Other best practices recognised by Data Administration Forum (DAF) (2002) are to develop an enterprise framework; develop the necessary standards for the enterprise model; establish guidelines and ensure proper conceptual data modeling standards are abided by; then finally to promote the framework and its components. Mullins (2002) also strongly feels that one of the most significant contributions made by DA's to organisations is the creation of data models.

Based on the similarities of best practices we can therefore derive the most important phases within data administration to firstly develop an enterprise model then to effectively maintain and manage data quality and finally to introduce and implement a central point for information sharing. We can also see that both Burns (2006) and DAF (2002) touched on the importance of simplifying processes by means of automation and developing frameworks.

The list of best practices mentioned thus far is only that which is most commonly used by data administrators. Best practices which are still lacking however are in the area of data cleansing (Wall Street & Technology, 2005). A study carried out by Tabb Group (ibid) showed that only 33 percent of companies are making use of best practices to cleanse and enrich data. This is unfortunately the situation even though Atre (2007) has strongly pointed out that:

“One of goals stated most frequently for business intelligence (BI) applications is to deliver clean, integrated and reconciled data to the business community”

Data cleansing as a best practice therefore also need to be recognised as one of the main phases to effective data administration. A DA would find this most relevant for data migration projects as it ensures the integrity and improves the overall quality of data.

3.2 Data Administration and Healthcare

Over the past few years there has been an increasing demand for improving information quality in the Healthcare industry (Niland *et al.*, 2006). Even though data management is maturing, data administration is still relatively young (McQuade, 2005). One of the reasons why companies tend to disregard data administration techniques is because they are not made aware of the competitive advantage and significant business opportunities it has to offer (Burns, 2006). While developers are more focused on applications and managers more on the business it becomes difficult to gather the

necessary time and effort to establish these techniques. Companies therefore fail to reap the benefits of an increased market share, increased customer satisfaction, improved efficiency and lowered costs (ibid).

In 2002 Bob better known as Robert S. Seiner, who is the publisher of the award winning “The Data Administration Newsletter” (TDAN), said in a special feature interview (2002) that data administration is becoming more important to all industries because of top management being forced to pay closer attention to the value of data. We see this happening today where data is being migrated from one system to another because of new business’s merging and acquiring new systems creating a whole host of new heterogeneous data environments (Zhao and Ram, 2006). This then results in data losing its initial value as it now needs to be reformatted/ modified in order to fit into the new environment. In such environments systems are required to share and exchange information across new information systems and sometimes have to operate on a nationwide standard using for example a standard master key index for linkage. In support of this Zviran *et al.* (2000) further expounded by saying that there is an urgent need for models and guidelines that must be able to serve as a tool to accommodate and support such standardisation of data and data integrity. Øvretveit in (Ritonja & Hocevar, 2001), on the other hand not only mentions that there is a dying need to improve healthcare quality but also mentions that these tools and methods such as EDM modelling concepts needs to be strategically planned and structured in a systematic approach. One reason is that it would simplify the incorporation of future data administration processes such as in the case of an organisation wanting to implement a new ISO data quality control check into a given migration process. Ritonja’s (2001) objective was to use a classification approach as follows:

- accurately record and collect the required data for new developments;
- model healthcare financing;
- plan the organisation of healthcare; and
- model healthcare strategy.

Based on this approach we can see that the modeling of systems plays yet another critical role in its development. By this planning, modeling and strategising approach diagnosis codes, disease treatments and other healthcare data have proven both theoretically and practically to add more value to business decisions (ibid).

Within the planning, standardising and modelling process Zhao *et al.* (2006) say one of the main problems that companies face is to identify the common processes and overlapping data among the different data sources. Serrano, Carver and Montes de Oca (2002) agree that there is a problem with standardisation of practices used when migrating data but further add that a framework needs to be established in order for this to work across different systems. The integration tools used for the migration process also differed to Ritonja's (2001) as it could be used not only for modelling but parsing (data cleansing) as well as data mining.

It is therefore evident that a new era of system migration and integration has emerged where there exist a lack of best practices and frameworks for managing and migrating data.

With this in mind as well as the findings in section 3.1 *Data Administration* we have therefore summarised that the prime concerns to be investigated and discussed will be around establishing a systematic and strategic framework that would be able to facilitate:

- 1) Data Modelling for the correct understanding, standardisation and integrity of data and processes
- 2) Data cleansing and Data integration to ensure data operates effectively in its new environment; and
- 3) Information sharing to ensure effective execution of the above processes as well as to aid future developments and migration projects

One of the main objectives will be to investigate and discuss these steps in a manner that is both comprehensive and structured in order that a framework can be developed. We have therefore decided to take a broad approach in our discussion. This type of approach would also allow us to apply the various methods to our *IT solutions* case environment in hope that it might be instituted as part of an organisations company policy.

3.3 Best Practices for migrating data

By looking at *Data Administration* in general as well as *Data Administration and Healthcare* we have highlighted the most important aspects of data administration to be data modelling, data cleansing and information repository. The following sub-sections will therefore further discuss these approaches in more detail as well as illustrate how it relates to the migration process.

3.3.1 Enterprise Data Modelling (EDM)

The fact that data modelling is one of the most significant contributions made by and basically sums up data administration it is usually the first and most important phase of developments (Mullins, 2002). An Enterprise Data Model (EDM) is a conceptual model that can represent almost any given business and have the ability to handle information from different sources (Rosaci, Terracina and Ursino, 2004). A source in this instance refers to real-life objects such as a car, manufacturer, client etc. There are two types of data models; one is the conceptual model that is a representation at a very high-level and then the logical model that shows the detailed entities/objects, data types, relationships, lengths and cardinalities (Mullins, 2002). Most modelling languages provide functionality to link these objects by means of relationships, which represents its actual relationship in the real-world (Mineau, Missaoui and Godinx, 2000). One of a EDMs' primary uses is to provide a platform of understanding and communication between the system analysts and end-users (Siau and Tan, 2005). This is possible through its broad view of a given business that is comprehensive to both techies and managers.

Mineau *et al.* (2000) also mentions that in one language, known as CG formalism, an objects behavioural aspect can even be represented. This has proven to be both easier to learn and master (ibid). Structural and behavioural representation on its own is however not sufficient if an EDM were to be included as part of a larger framework. Niland *et al.* (2006) suggests that in this case data elements and processes will need to be standardised in order to simplify the integration of data from multiple sources. Standardisation for data migration is yet another advantage of an EDM where the objective should be to discover common threads across different functions and then to define a common definition for given entities (Long, 1998). Even though standardisation offers great benefits to businesses, agreeing to a single enterprise standard is still a major problem and has been listed as one of the biggest challenges in data modelling (Perkins, 2007).

Another important aspect of data modelling is the quality and meaningfulness of what is being represented. Niland *et al.* (2006) gives basic steps to improve healthcare quality in specific:

- Data perspective: describe *what* information is of interest
- People perspective: describe *who* develops and use the system
- Procedural perspective: describe *how* the system functions

Once this has been defined then the rest falls into place. Siau's *et al.* (2005) however has a different approach to improving the quality of conceptual models. The approach taken by them involves requirements analysis as follows:

- Requirements specification: understanding the organisation situation as well as the systems needs and constraints
- Requirements negotiation: to established and agreement of the systems requirements amongst the different stakeholders involved
- Requirements representation: to map real-world needs to the model
- Requirements validation: to ensure that the specification corresponds to the stakeholder expectations and conforms to all standards and constraints set by the organisation and its environment

Niland *et al.* (2006) and Siau's *et al.* (2005) approach can be viewed as the most essential pre-steps to developing effective data models. We have therefore decided to include this as a pre-requisite to data modelling within our framework. This will however not be discussed as a section on its own as we view it as part of data modelling and not a separate process.

During the requirements and data modelling phase it is important to deposit all documentation, analysis, drafts and other information into a central repository. This will enable the development team to always be on the same page (O'Neil, 2006). This will also allow them to better understand the flow of the data migration process by better understanding the data models intricate interactions, dependencies and other complex behaviours. It would also improve communication between the various team members (Perkins, 2007) as well as provide the opportunity for external stakeholders to get a better idea of what processes the business is involved in. This flow of depositing and retrieving information to and fro a central base should be an ongoing one to always refine and improve processes and to facilitate future developments.

Based on the findings in this section the main aspects to data modelling that is to apply to our framework is first to identify the necessary requirements for data modelling. The requirements output would then form the foundation by providing clear and defined objectives of what needs to be modelled; for whom it needs to be modelled; and how it needs to be modelled. This is then

transformed into a model that is understandable and usable by both technical (developers etc) and management employees. Finally all entities and objects names and definitions are standardised in order to ease the migration process.

By identifying critical data and enforcing standardisation at an early stage the process of data cleansing becomes less troublesome (Firstlogic, Inc., 1999). This takes us to our next section where we show the various steps involved in cleaning data when migrating it, hence improving its overall quality.

3.3.2 Data cleansing and integration

Having accurate data has always been one of the biggest challenges in information systems (Firstlogic, Inc., 1999). Data cleansing improves the quality of data through a set of critical steps, which has been defined by Firstlogic, Inc. (1999) as:

“...three stages: cleansing, matching, and consolidation. In the data cleansing stage, the data is parsed, corrected, standardized, and enhanced for accurate matching. In the matching stage, comparisons are made within and across your data sources to locate similar information. Finally, the matching data elements are consolidated and placed into a data warehouse, data mart, or other data storage area.”

The fact that our framework first standardise data in the modelling phase ensures optimal data cleansing by reducing the time and effort required. Liem, Wahyudin, & Shatten (2006) however say that data cleansing is not a process that should happen quickly, especially during data migration. They suggest that data be migrated and cleaned gradually in incremental stages based on its priority. Both Atre (2007) and Firstlogic, Inc. (1999) however strongly feels that organisations should first identify what data is most important to the business and then provide a set of cleaning criteria for this. This therefore supports our framework where the most important requirements for the business model are first identified then deposited into the information repository, which can then be made available to the data cleansing phase.

Another major problem when cleaning data is duplicate detection (Schallehn, Sattler and Saak, 2003). This is most commonly found amongst earlier approaches to integrating data. Here disparate data needs to be matched and can only be done so using methods which are restricted to similarity

checking based on attribute and derived values. Newer approaches however attempts to analyse real-life requirements using special matching algorithms, where similarity matching would hardly be capable of doing the job (ibid).

One of the more recent approaches is that of Atre's (2007) that uses a set of data selection criteria to check data integrity, precision, accuracy, reliability and data format. Any discrepancies found in this process would then be refined and incorporated back into the data model. This interaction between data cleansing and expanding the data model is a continuous process of refinement where additional discrepancies and inconsistencies are identified and updated back into the data model. This would therefore improve cleansing migrated data as it can be verified directly against the models cleansed data.

Our framework therefore adopts this methodology of ongoing refinement in order to attain maximum results from the migration process. Once again it is of utmost importance to store all information gathered during the cleansing/refinement phase into the central information repository so that past experiences either be avoided or used if it is of benefit. The repository would also allow us to verify whether the data model is up to date with the latest anomalies returned from the data cleansing phase in case any is missed. This then takes us to the next section where we discuss the various aspects to information repository and how it is interlinked with the various phases.

3.2.3 Information Repository

An information repository is a place where an enterprise generates, stores and disseminates information in order to improve productivity, reduce duplication and minimise maintenance costs (Perkins, 2007). This information shared can be in the form of documents, databases, audio, video, formatted output or any other form of information (Seiner, 2001). Seiners (2001) however say that information only becomes manageable, sharable, and reusable if it is recorded or archived somewhere and made available. He also say that sharing best practices and establishing consistent processes, such as our framework, are two of the biggest contributions of information repositories. Another important point he makes is that the exchange of information removes the risk of employees leaving with all the knowledge they usually have in their heads.

According to Call (2005) this has become the latest trend in databases as well as one of the fastest growing areas of corporate spending. He also recommends Kiri Nesbitt's Essential steps to information sharing that focus on satisfying business requirements, improving access and usability as well as to strategise ways to reduce duplication, gaps and overlaps. Here we see that implementing an information repository strategy will afford us the opportunity to identify gaps and overlaps within the migration process at an early stage already.

One of the latest trends to information type repositories is called "Knowledge Capture", which is a Wikipedia version of an information repository (O'Neil, 2006). Here search tools are used where simple terms can be entered to perform quick searches, demonstrating to everyone the importance of the information exchange. Other advantages facilitate training of new employees as well as victims of migration processes. When data is migrated from one system to another it also serves as a medium of translation between the two system vocabularies and semantics (ibid).

By incorporating a Knowledge Capture strategy as the underlying part to our framework we will be able to create an environment where information is transferred back and forth between all processes in an iterative manner in order to ensure that all employees are always using the same standards, learning from the same resources and sharing the same information.

Based on our discussions and findings we can therefore now define our framework as one that includes:

- 1.1) Requirements definition for data modelling; the *who*, *what* and *how* of data modelling
 - then linking this to the information repository and using its outputs as input to data modelling
- 1.2) the actual Data modelling phase focusing on comprehensiveness and standardisation
 - then linking this to the information repository and using its outputs as input to data cleansing and integration
- 2) Data cleansing and integration phase using a set of criteria on selected business data
 - then linking this to the information repository and using its outputs as input back into the data modelling phase
- 3) the underlying information repository based on a knowledge capture approach

- interlinking this to all phases in an iterative manner for storing, sharing and disseminating information.

The proposed framework as seen in figure 1.

See Appendix

It is important to note that our framework is defined within the parameters of this study so that we may apply it to our Healthcare case. The framework can be further expanded by means of an empirical study that is out of the scope of this article.

4. IT Solutions Case

4.1 Background

IT companies who provide Medical aid administrators with new IT systems often require improving data administration processes when migrating legacy data from the old system to the new system. This migration process is also referred to as the take-on process where standard guidelines and data strategies are often neglected or overlooked. This is one of the primary reasons for take-on projects to fall behind schedule exerting unnecessary time and effort (personal interview, June 1, 2007).

IT solutions¹ is one such company that offers the latest IT systems, technology and backend support to medical aid administrators. A typical take-on process would require data to be moved across from the medical administrator's legacy system to the new IT system as shown in fig.1 where IT Solutions is involved in most of the migration process.

Client: A medical aid administrator that administers a host of medical schemes/aids. These administrators operates in the private sector and offers services to their medical schemes such as membership management, claims assessing, health risk management as well as other insurance and fund related management. These services are provided in order to optimise on resources as well as to improve the overall quality of member and fund management.

IT Solutions: A backend leading IT company in the healthcare funding industry providing cutting edge IT systems as well as support, development and maintenance to healthcare administrators. The IT system is capable of dealing with claims assessing, rules, premium-raising algorithms as well as

other financial processing. The system also incorporates real-time switching technology and electronic claims processing (EDI). This enables Healthcare administrators to thus improve the way they communicate with their stakeholders.

Third Party: A separate entity who specialises in the managing of health information such as performing membership eligibility, claims duplication, data warehousing and other checks. The Third party would be responsible for switching claims between the pharmacies/doctors and IT backend company. They are also responsible for providing the EDI files and other batch related files to IT Solutions for processing. They would typically function as the middle-man between information coming from outside sources and IT solutions (Administrator system) by means of interfaces.

IT Solutions and the Third party would most likely be the primary beneficiaries of this research. Steps in the migration include:

- 1) The Client, in this case being the Medical aid administrator company, would provide the necessary data from their Legacy systems to a third party. The Third parties would be responsible for the data handover to the new IT backend company to be loaded on the new system.
- 2) The Third party in collaboration with the IT solutions would arrange and agree upon certain procedures and methods to transfer the data successfully. The data is usually handed over to IT solutions in stages where there is first a set of test run data and then the live run data. This can either be transferred via a file transfer protocol (ftp) or be put on a digital video disc (DVD).
- 3) IT solutions would then allocate data sets to the appropriate resources, who in turn would extract, transform and load (ETL) the data at the relevant locations on the new system. They also need to ensure that it integrates and operates efficiently with the new system data and processes.

By means of an interview, conducted with one of IT solutions developers, we were able to identify the most common issues raised during migration projects (personal interview, June 1, 2007), this included:

- misunderstandings of the new IT system and its requirements
- unstructured procedures leading to duplication of processes
- ineffective communication networks resulting in missing files and duplication of data
- erroneous data and files
- certain types of data that can either not be accommodated for or have different formats
- no central point for information sharing and future knowledge transfer

It is important to bear in mind that the issues raised here may not be confined to a Medical aid take-on/migration project only and could well be common in almost every IT support company (Strong, Lee, and Wang, 1997). The following sections will look at the application of the literature review to the case and attempt to show how using best practice data administration techniques can improve such projects.

4.2 Applying EDM

The first step in applying our framework is data modelling where we first perform the requirements analysis asking *who*, *what* and *how* questions of modelling. By doing this we realise that the IT Solutions administrator system needs to be modelled in a way that is understandable to both end-users (CLIENT) and IT Solutions and at the same time to clearly illustrate all membership and funding processes, relationships and functionalities. This allows the medical aid administrator to immediately identify and understand how their data is to operate and function with the new business processes. It also removes any misunderstandings between stakeholders, serving as a platform for communication. Following Niland *et al.*'s (2006) advice, enforcing standard definitions ensures consistency and data integrity across both IT Solutions and Legacy system data. During this phase all information gathered from the requirement analysis and EDM development is deposited into the information repository. Here information can be accessed by any resource to refine current or future processes.

Above all IT solutions will be able to use the EDM and information repository as a life-long tool to:

- Facilitate future migrations
- Guide developers and other employees in the extraction and integration process
- Simplify the incorporation of new business and administration processes

4.3 Applying Data cleansing and integration

Based on the EDM and repository outputs from the previous phase it becomes easier to identify what data is pertinent to the medical aid administrator needs. This provides a starting point for cleansing and integrating our data as per Atre (2007) and Firstlogic, Inc. (1999) recommendations. The next step is to use Atre's (2007) set of migration criteria to validate data integrity, precision, accuracy, reliability and data format. The process decided on includes:

- Creating similar subsets of the critical data

- To extract and migrate portions of data incrementally, following Liem *et al.*'s (2006) advice
- To clean this data based on Firstlogic, Inc. (1999) special algorithms
- To match this data and check for any redundancies; and
- Finally to consolidate the data in the relevant locations on the new systems, following Firstlogic, Inc. (1999) techniques

The cleansing process is an iterative one where discrepancies and inconsistencies are updated back into the EDM then standardised once again with the rest of the model data. This process between the data model and cleansing phase would happen iteratively until all criteria have been met. This allows any new data being migrated to be verified directly against the EDM data and loaded into the appropriate locations on the new system instead of going through the cleansing phase again. This also alleviates previous problems experienced around missing files, duplication of data, erroneous data and unnecessary data.

All information gathered during this phase is deposited into the central repository to serve as ongoing guidance as well as to optimise on the time and effort needed for future migrations.

4.4 Applying a Information Repository strategy

The strategy should follow a “Knowledge Capture” approach and implemented as a central information repository across all IT Solution processes. It should be linked iteratively so that each phase can benefit and complement one another. A Knowledge Capture style also provides a quick search tool, which should also increase the interest of IT Solution employees to participate in the strategies aims and objectives. This would also allow us to identify any gaps of misunderstandings between the given parties. A central repository also reduces the rate of overlapping data from different sources by maintaining standard formats and standard definition.

This also serves as initial training grounds for new comers to IT Solutions or anybody who might need reference to the different vocabularies and semantics used between the different machines being migrated to. An information repository strategy therefore plays a crucial underlying role in our framework as it is interlinked with all phases that are also dependant on it.

5. Conclusions

In this study we showed the imperative role data administration plays in the management of data. This we especially demonstrated in Healthcare where the increase of heterogeneous environments and data migration is becoming a prime concern. Our approach first identified key best practices for migrating data by looking at data administration in general then data administration in healthcare. The core and most fundamental practices discovered included the requirements analysis and creation of data models that used standard definitions and could communicate processes between end-users and IT; data cleansing techniques that used a specific set of criteria for selected business data; and information repository strategies that could be used to enhance projects and at the same time encourage employees to participate. We then took on a unique style by incorporating these best practices into a comprehensive framework, which we then further explained and applied to a real-life medical aid administrator environment. The development and application of our data administration framework is unique in that it represents an entire data administration architecture including its process flows and how it could not only benefit data migration projects but any IT project at that. Based on this research we hope to have proved the importance of data administration required for migrations and other projects and also to have changed the perceptions that many companies have on data administration.

6. Limitations and Future work

Our research is limited firstly because it looks at data administration on a high level. Secondly, because our framework is only defined within the parameters of our case study and requires further expansion by means of an empirical study. Lastly, because the framework was only applied theoretically and still needs to be put into practice. Future work in this area therefore requires an in depth study of our framework, its components and process flows as well as to institute this as a pilot-run within IT Solutions migration projects.

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Acknowledgement:

This paper is based on research funded by Academy of Finland grants no. 39187 (INDEHELAMethods,19982001), 201397 and 104776 (INDEHELAContext, 2003, 20042007): www.uku.fi/tike/indehela

Networks of Action and Health Information Infrastructure: enabling Federations

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***ABSTRACT.** Global scale e-health projects, usually managed by international organizations, often fail to get rooted in the variety of contexts they address. A frequent problem of local e-health initiatives run by public administrations and NGOs is their fragmentation and lack of coordination. This paper aims at identifying a mid-range empirical area and a meso-level theoretical perspective in order to propose an infrastructural approach to ICT-based health development. Relying on studies of information infrastructure evolution, and long term experiences in fostering collaboration across a variety of health development efforts, we propose to practitioners and researchers to conceptualize existing systems as potential hubs of an eventually emerging health information infrastructure, and to manage them accordingly. The proposed steps in that direction are the constitution of "networks of action" and the federation of socio-technical systems. Selectively integrating running systems and coordinating existing organizations is a way to move the design locus closer to where practical local knowledge is situated, and build on top of it. Finally, we spell out recommendations about how to proceed in that direction.*

***Keywords:** e-health, networks of action, information infrastructure, integration, socio-technical innovation, development*

1. INTRODUCTION

2007 was the International Year of Science and Technology for Africa. We were not aware of this fact until one of the authors received an invitation for a conference aimed at gathering e-health projects and presenting them to policymakers in the Italian parliament. A number of organizations and initiatives were presented. Some of them surprised us, for example we discovered that Italy has a long tradition in telemedicine, because of pioneering sectors like radio communication and navigation, the alliance of which originated - over seventy years ago - an organization providing radio-medical assistance to ships all over the world. A relevant characteristic of the participating projects was a lack of or blurred separation between projects in developing and "developed" countries.

"e-Health is an all-encompassing term for the combined use in the health sector of information and communication technology (ICT) for clinical, educational, research and administrative purposes, both at the local site and at a distance. It lies at the intersection of medical informatics, public health and business" (Kwankam, 2004). Often e-health initiatives focus on technologies to enable distributed

organizations (remote second opinions, data collection for monitoring and evaluation, etc.). Dispersed organizational patterns have proven able to provide health services: technologies, procedures, recommendations, and practices solidified in one context have migrated to other places. This gives some empirical ground to expectations for dealing with health in Africa also through ICT. Nevertheless, our overall opinion is that socio-technical fragmentation remains the main obstacle to effectiveness, efficiency and sustainability.

A decade ago, Castells (1998), engaged by the United Nations Research Institute for Social Development Conference on Information Technologies and Social Development, wrote “The most critical distinction in this [network] organizational logic is to be or not to be — in the network. Be in the network, and you can share and, over time, increase your chances. Be out of the network, or become switched off, and your chances vanish, since everything that counts is organized around a worldwide web of interacting networks.” The centrality of networks in the contemporary world is widely accepted, with their growth not only geographical, but increasingly taking place across disciplines and fields of activity (Benkler, 2006). The widening gap in science and technology between the South and North can push the South out of the network. Here we propose an approach to establish and strengthen “South-South-North” networks based on "Networks of Action" and contemporary research on the evolution of information infrastructures. The aim is to provide a framework to facilitate sustainability and scalability of a transnational health information infrastructure.

This paper is organized as follows: global health and information infrastructures are presented. After that, the concept of "design - reality" gap is discussed as a main cause for frequent failures of e-health projects in "developing country" contexts. The following section pulls together concepts from contemporary information system research in order to address theoretically and empirically the area of federation of e-health projects and systems. The proposed modus operandi is discussed in contrast with the problems of both "grass root" and "one size fits all" approaches, which fail in addressing variety and scalability/sustainability, respectively. We conclude this document with recommendations about how networks of action can play a "transformative" role by facilitating the federations of existing efforts into a health information infrastructure.

2. RESEARCH APPROACH

All authors have been involved, to different extent (from one to four years), in active participation in a project which we here choose to call PHIS, within a broad frame of action research. Specifically, direct involvement took place at all levels of PHIS activities, from global software development to local implementations in different countries (including capacity building initiatives). Because of the action research framework, the differentiation between the researcher and practitioner roles was blurred, and learning took place also through action. One of the authors was a member of the scientific board and a speaker at the conference in the Italian parliament. This provided a good overview of the event. Documentary studies on PHIS documentation and interviews have also been important sources of information.

3. GLOBAL HEALTH AND INFORMATION INFRASTRUCTURES

Information infrastructure, as contrasted with information systems which typically concern independent or stand alone systems, are large scale, complex, and networked technologies such as the Internet. Health information infrastructures can improve dependability, quality of service, coherence, and affordability of services to patients and societies. For the purpose of this paper, we propose to conceive a health information infrastructure as the eventual emergence of a federation of health information systems, comprising both technologies and organizational elements. Transnational (global) information infrastructures requires a broad view on information technologies, and include both the technical components (such as technologies and standards), and also social and organizational elements such as work practices, human resource issues, politics, and other institutional conditions. A central theme is how information technologies emerge and grow in use, in order to propose specific approaches for how appropriate and beneficial applications can be adopted, scaled up, cultivated, sustained, and institutionalized over time.

Social and interorganizational networks are increasingly based on and constituted by information infrastructures. Yoo et al. (forthcoming) posit that "new kinds of information infrastructures play an increasingly vital role in creating and sustaining innovation networks". So, what is a health information infrastructure made of? Beyond the *material elements* such as a) the network of wires, cables, computers, b) the organizations producing, requiring and using information (Ministries of Health, statistical bureaus, international organizations, etc) and c) people and facilities using and enacting the infrastructure; other *immaterial "layers"* have to be considered: software, datasets (like the

International Classification of Diseases – I.C.D.), information flow schemes, institutional settings, procedures, policies. Another way to categorize the building elements of information infrastructures is to consider “vertical” systems: telemedicine (telediagnosis, teleconsulting, telemonitoring, telepathology, telecardiology, e-learning), electronic patient records, clinical and epidemiological data bases, hospital information systems, healthcare portals, and eventually health grids.

Frequently, such projects are run by different organizations like local ministries, United Nations, World Health Organization, Organization for Economic Cooperation and Development countries’ public agencies, non-governmental organizations, consulting firms. They often prove to be uncoordinated, while local ministries’ personnel have to spend much time and resources in dealing with unrelated –and sometimes conflictive- initiatives and donors. The coordination, and the concrete possibilities for coordination, can be inscribed into the projects’ guidelines and technologies. An argument in this sense is a point of this document. Historically, many infrastructures emerged through the integration of existing systems, and standardization has been a key element in the establishment of infrastructures. The same is the case for information infrastructures (Hanseth, 2001). Choosing appropriate integration strategies and technologies that find the appropriate balance between the needs for smooth information flow on the one hand, and stimulate and enable innovation, learning and improvement of organizational performance on the other is a critical success factor. Indeed, tight integration enables smooth or seamless information flow while loose integration gives better modularization and accordingly makes the infrastructure more flexible and easy to change as requirements change. But information infrastructures also raise new challenges: infrastructures and standards support specific work processes, and those work processes get embedded into the infrastructures and their standards. Thus, as standards freeze originating contexts rather than enabling their improvement, you may encounter problems to transfer them. This dialectic between local specificities and global requirements, flexibility and standardization (Hanseth and Monteiro, 1997; Braa et al., 2007) are here presented as central in concretely relating global health and information infrastructures.

Kallinikos (2006a, 2006a, 2006b) addressed the self-referential effect of escalating information growth. From this perspective, we can expect health care development as an unintended (and hardly manageable) side-effect of such growth, or we need to counterbalance assumptions about network and information determinacy, roughly speaking. The improvement of health conditions in Africa (and

elsewhere as well) through information technologies cuts across many non-geographical boundaries, like those between medicine, politics, innovation, development and organizational cultures. Bowker (2000) addresses the issues, and consequences, of data integration.

One of the bottlenecks in the development of effective healthcare systems (which also rely on health information systems, patient record systems, laboratory systems) is the at once centralized and fragmented nature of specific health care activities or programs. For many years the health organizational context has become increasingly complex and dispersed, with health programs operating as tightly controlled silos, resulting in an overall lack of coordination, and therefore in poor quality and ineffectual use of information. Poor focus on the development of local expertise and tendencies of neglecting social and organizational issues are cited as major factors contributing to the problem of ineffective implementation of computerized healthcare systems. On the other hand, the macro level (intended as the broad implementation of universal design plans) is problematic as well, because it proved to clash with the variety of contexts it has to deal with.

3. THE “DESIGN – REALITY GAP”

Though there are ambitious visions for the African Union in many fields, supranational authorities for coordination of efforts to improve health care delivery through ICT on a continental scale are lacking. And even if a strong coordinating body were to emerge, it would not be sovereign in making national health decisions. Therefore, we argue that the process needs to be, to some extent, bottom-up, and find its ground in existing projects *to be progressively federated*. As a first step, we propose facilitation of interoperability among existing projects, and with new ones.

A number of researches examining the implementation of ICT in African contexts have reported on a wide range of cases where systems end up as total or partial failures. The gap between the design of information systems and the realities of use contexts has been found to be a key factor contributing to ICT implementation failures (Heeks, 2006). Addressing these challenges is not merely a quest for increasingly sophisticated technical solutions, but to identify and engage with approaches that take into consideration the complexity and heterogeneity of the socio-technical contexts that constitute and support information technologies. Although this will not be discussed directly in the present document, the authors think that increasing collaboration and federation across projects is not only a technical issue, but requires the fostering of learning and innovation. To deliver sustainable benefits

over their lifetime, infrastructures need to enable processes of experimentation, discovery and inventions through trial and error.

Technologies and information used in the systems to be federated requires the sustenance of an emphasis on local environment. It is recommended that the federations capitalize on the varying knowledge from different (geographical and knowledge domain) contexts they connect. “Highlighting the multiplicity of knowledge provinces with their respective worldviews opens up understandings of sociotechnical design processes and of knowledge work. The concept of a range of knowledge provinces enables description of dynamic configurations with shifting boundaries and supports planning for a diversity of arrangements across the digital landscape” (Baker and Millerand, 2007). A globally scalable infrastructure for health cannot be designed in the economically developed world only, as it would then fail to be adopted in such a variety of contexts. As there is no supranational sovereign organization to legitimize its adoption and use, a transnational health information infrastructure endorsement and development cannot be but bottom-up. In order to find the balance between local specificity, interoperability, and standardization (Rolland and Monteiro, 2002), open processes of continuous and long term negotiation are required. In other words, a globally scalable information infrastructure is of necessity "cosmopolitan".

In practical terms, this means that the initial hubs of the emergent health information infrastructure for Africa are likely to be found among already existing initiatives on the ground, developing and implementing health information systems. Ongoing initiatives are the privileged loci of design, but interoperability needs to become a priority – in the broader sense of ability to establish socio-technical coalitions and federations. Last, but not least, established projects -if connected as dots of an infrastructure- have already gone through the critical bootstrapping phase of information infrastructures development (Aanestad, 2003).

4. NETWORKS OF ACTION FOR HEALTH INFORMATION INFRASTRUCTURE DEVELOPMENT: FEDERATING SYSTEMS

In a critical review of the contemporary literature about information systems in developing contexts, Avgerou (2007) identifies three discourses: 1) transfer and diffusion, 2) social embeddedness and 3) transformative. The last of these is rooted into the second, and both 2) and 3) differ from 1), because they conceive target contexts not as passive recipients of ICT, but as parts in the evolution of

innovations. In Avgerou's view, the main difference between the last two discourses is that for "social embeddedness", information systems are locally constructed, whereas the "transformative discourse is explicitly concerned with the way ICT is implicated in the dynamic of their change [of social, economic, and political relations in a developing country or the world at large]." (idem p.8)

Avgerou states that the social embeddedness discourse is sensitive to local dynamics and situated meanings and actions. The transformative discourse introduces new elements beyond organizations and interorganizational links: institutions, broad social collectivities, and power relations beyond organizational settings. Thus, the transformative discourse intercepts an empirical area, which is situated at the meso-level between global initiatives and discourses and emphasis on specific implementations. At this level, we see an intersection with the "Networks of Action" strategy (Braa et al., 2004), a proposal to conceptualize and conduct each intervention "as but one element in a larger network of action." Aiming at extending the Scandinavian tradition of action-research, Braa et al. advocate for situating actions within networks, rather than leaving them as singularities. This strategy proposes a solution to problems of both sustainability and scalability. It makes sense here, because we advocate the need to pull together scarce and dispersed resources for e-health and federate them into infrastructural hubs also by inscribing (possibilities for) coordination into technologies and related organizational, political and institutional patterns.

According to Yoo et al. (forthcoming), "advances in digital technologies 1) reduce communication costs and thus increase the scope and reach of communications between actors; and 2) increase digital convergence which help integrate uncoordinated activities, artifacts and capabilities". Thus, the process manifests itself along two different axes: First, the emerging information infrastructure provides a basis on which existing interaction between health practitioners, administrators, policy makers and medical scientists can be made more efficient and strengthened, with more timely responses. Furthermore, it becomes feasible for widely distributed actors in the same field to cooperate, so that local experiences from e.g. Limpopo can be of help to Eastern Cape, or be communicated to Nigeria (though such processes will likely involve organizational changes and negotiation, as well as local translation). Second, the convergence of infrastructural elements enables completely new constellations, shaping and being shaped by innovative services. As the federations converge in an infrastructure, improvements take place – new parts added and existing parts replaced. For example, a project with a focus on mobile reporting of routine data can find synergies with

another project working on the digitization of a common platform of standards for communication, classification and ways of operating greatly *and in an accelerating manner* (Kallinikos, 2006) increases the scope for heterogeneity in such networks of collaboration and innovation across traditional boundaries. Thus, previously incongruous organizations can now realistically form part of innovation networks for mutual benefit. And this is not likely to go away, as Hasselbring (2002) underscores: "It is not always possible – and even not always reasonable – attempting to eliminate autonomy, heterogeneity or distribution entirely. For instance, distribution is a matter of fact when connecting systems of dissimilar organizations. Autonomy allows for flexible architectures whereby individual subsystems are able to adapt themselves to changing requirements. By allowing for heterogeneity, organizational departments may choose the optimal systems for achieving their business goals."

Yoo et al. (forthcoming) posit that innovation networks will differ in their characteristics according to their placements along these axes of distribution of control and need for coordination on the one hand, and the heterogeneity of available knowledge on the other. They propose the term *singular innovation form* for a traditionally coordinated network of homogeneous knowledge resources, whereas a more buoyant open source project with a number of widely dispersed individual actors working with minimal centralized control, but on still on a relatively homogeneous platform of technologies and procedures is coined a *distributed innovation form*. Similarly, they give arrangements linking highly diverse knowledge communities while maintaining centralized control, such as collaboration in industry associations, the label *systemic innovation form*. Finally, there are networks with both highly dispersed control and very diverse epistemic communities. Thus they possess a high complexity in both dimensions. Such *doubly distributed innovation networks* are often seen in new markets such as that for new mobile services, or in radically innovative projects where a myriad of previously unconnected actors from different trades are pooled, while each community of practice continues to follow its own logic and trajectory (Yoo et al., forthcoming), mobilizing actors with highly diverse perspectives to overcome obstacles to collective action in highly heterogeneous and contested technological tools and capabilities. This increases the scope for both heterogeneity in such networks of collaboration and innovation across traditional boundaries. And the heterogeneity is not likely to go away soon". However, operating in such heterogeneous environments puts a heavy burden on cognitive and social translations, enabled by extensive dialog and the use of significant boundary objects (Carlile, 2004). Over time, a common technological frame may emerge, in which

case heterogeneity is reduced, and the network transforms into a singular or distributed innovation form.

See Appendix

Braa et al. (2004) describe an approach characterized by a "South-South-North" collaborative processes, abandoning singular, one-site projects in favor of long-lasting networks for sharing of experience, encouraging local learning processes. The strategy for building networks of action is to start small, establish what works, and evolve, akin to the "Bazaar" model of open source software production (Raymond, 1997) characterized by an ethos of "release early and often, delegate everything you can, be open to the point of promiscuity". The networks of action and the bazaar models share a basic acceptance and openness for the variety of the matter they deal with. Both stress the importance of not starting from scratch, but rather use what has already been done, get it out there, let go of full control, see what constellations emerge from there. In this sense, the focus of these models is not on abstract planning of optimized, complete solutions, but on building on promising partial pieces, using real world feedback. In our fieldwork, we have observed many instances of the value of federating several sites in a network to cope with fragility, where projects may be held up or in danger of cancellation because of changes to the economical or political environment, or when unforeseen obstacles arose and experts from other parts of the network could be called in or the focus of the efforts temporarily shifted to a different site. Unlike the "one size fits all" singular innovation approach, the federating approach is flexible. Furthermore, network effects made the network itself an attractor after it reached critical mass, leading to further geographical expansion and collaboration with increasingly heterogeneous actors, thus moving in the direction of doubly distributed innovation, following a *strategy for modular alliances* to strengthen the weak areas and learn from each other, without impeding local practices and flexibility (Bowker and Star, 1999).

The establishment of a health information infrastructure operates simultaneously at the concrete level of participatory design and implementation (fields in a database, capacity building, integration of datasets and organizational practices...) and at a theoretical one (dealing with the relationships between information science, organization, public health, and global software development, among others). Understanding what infrastructural elements can be translated into the heterogenous public and private sector contexts of African countries is a matter of development strategies. Federating information systems for health monitoring and global policy making requires the gradual dissolution

of the current disjunction of disciplines (informatics for databases and policy-making as way of acting in the world). Thus, instead of being seen as a monolithic system which regulates individual action, order comes to be seen as an upshot of concrete, communicative interaction, creating a broad network to circulate (multiply) innovations / dilution of side effects.

Our claim is that the highly fragmented overall nature of health care initiatives for Africa and the limited scope for centralized control points to such doubly distributed innovation networks as the most promising strategy for large scale and sustainable innovation in this field, though substantial infrastructural investment is needed for them to succeed. Still, many of the building blocks of such an infrastructure can be taken from the frameworks underlying ongoing projects. In this way, rather than each project remaining isolated and autarchic, and thus fragile, federations of projects ceding some control in a process of *infrastructuralization* (Nilsen and Aanestad, 2005) stand a much better chance of having lasting effects. Jonas (2006) defines sustainability as the ability of the system to stay operational through high volumes and changing times, i.e. by delegating common functionalities to an open or federatively managed infrastructure, each project gains the benefit of resources created by others, and at the same time is freed from shouldering the full cost of maintaining its own technological and informational platform. Therefore, by creating loose or tight federations and pooling their elements, projects may be able to bootstrap an infrastructure (Aanestad, 2003).

Our empirical observations indicate that the rudiments of such networks are already coming in place, as seen e.g. in discussions around the integration of a whole range of systems at a WHO conference in Nairobi (WHO, 2007). International organizations such as the WHO and major donors thus play a vital role in facilitating open processes of standardmaking (CBC News, 2007), mapping out existing projects, and acting as matchmakers, sowing the seeds of strong alliances. This is underscored by recent decisions by the WHO to go beyond the creation and dissemination of software like Health Mapper (WHO, 2008) without cost, and into the planning and releasing of software under a fully open source license, thus expanding the scope for collaboration further.

To sum up, centralized design and "diffusionist" rollout proved not to work for infrastructural evolution, but the case of PHIS shows that technical and organizational federations can be effectively undertaken in developing countries. Still, grass-root initiatives naturally have their champions and local functionaries. Blind adoption of initiatives and changes at local level can bring unintended side

effects to a system. Direct transfers of systems from one grass-root initiative often lead to failure -the kind of mentality saying "it worked in Limpopo, so it will automatically work in Maputo". The local environment has to be assessed. The PHIS implementation in Cuba was not as successful as in South Africa, due to the extremely centralized nature of the Cuban health sector. Furthermore, in countries where vertical programs are organized with little horizontal integration, a PHIS initiative which worked in a one locality must adapt to the local practices prior to implementation elsewhere.

5. NETWORKS OF ACTION FOR INFORMATION INFRASTRUCTURE DEVELOPMENT

Various arguments have been raised by development studies to establish "South-South" collaborative networks. Sharing of resources can also help the long-term sustainability of information systems implementations. It has been argued that it is important to develop "networks of action" within which groups and organizations in the South can share experiences and support each other in the effort to develop software that is matching with local requirements, sustainable on the long term, and globally scalable (Braa et al., 2004). The PHIS network was initiated in 1994 as a health information project in South Africa, in collaboration with a Northern European university. From 2005, the European Commission funded this initiative by supporting the strengthening of collaboration links between the nodes of the network. These linkages consist in sharing experiences, skills, products, and processes between similar contexts. Indeed, the PHIS network comprises of international training programs and open source software development teams which have now expanded from South Africa to Ethiopia, India, Vietnam among others. Similarities across contexts can thus help to close some of the "design-reality" gaps, and contribute to more effective development and application of suitable solutions for a health information infrastructure. Without such cooperation and support mechanisms, there will be a continuous dependence on financial and technical support from donor agencies, which has been empirically found to lead to many initiatives without long horizons, broadly resulting in partial and complete failures in the longer run. Many systems, indeed, often turn out not to be scalable beyond pilot projects or sustainable once donor support is withdrawn, and do not lead to the building of suitable cooperation on the inter-organizational, institutional and political levels. Peer-to-peer, South-South collaboration needs to find its legs in the interoperability of ICT-based initiatives, and represent a concrete possibility for relating sustainability and scalability. Such networks of action, here proposed as collaborative groups and federated initiatives, have to be enabled by, and will also enable, the circulation of software, training material, experiences, and people across networks. Such multi-level networks provide the potential to coordinate the growth of a health information

infrastructure, upon which substantial development activities hinge.

5.1. Levels of Federation: Technical, Organizational and Political

Services and applications impacting health need to be tied together to cross-fertilize each other; this is the reason for interoperability at the technical level (negotiation and definitions of protocols, tools, datasets, standards,...) and the establishment of coalitions at organizational and political levels. Such processes do not promise results in the short term, but constitute the basis for long term efforts to be effective. Major federation issues in handling distributed autonomous and heterogeneous systems are:

- . Technical
 - . datasets, large databases - warehouses, information flow schemes, and database management systems
 - . software development and debugging procedures, architectural considerations, deployment platforms (for the continuous negotiation and definition of protocols and tools)
- . Organizational (hospitals, public and private companies, peripheral facilities)
 - . heterogeneity in provision and access to information (and related conflicts of interest)
 - . integration of different levels (syntactic, semantic, related responsibilities)
 - . unintended side-effects (increased complexity through coupling of previously separate elements)
- . Political (Ministries of Health, of Innovation, of Research, of Technology, international organizations like WHO and donors)
 - . Re-ordering relationships (re-distribution of burdens and benefits)
 - . Balancing (central) control versus (distributed) autonomy
 - . Re-ordering relationships (who is in/out and with what power)

Markets and structured organizations (hierarchies) are the two poles in between which actual organizations position themselves. Here we propose an incomplete list of interorganizational arrangements (federations) which can be seen as ideal-types of balance between flexibility and stability.¹

¹ Weill and Ross (2004) propose a table on a more political classification about IT governance.

5.2. Strategies for Scaling and Sustainability: Incremental Change of the Installed Base

Federating e-health systems to develop a health information infrastructure is a way to actively take into account legacy systems that not only represent inertia and hinder change, but also a resource for their being part of existing activities and procedures. Terming this process "federation" is a way to avoid both technological reductionism and tight coupling implied by "integration". On one side, a federating approach helps scalability. On the other, it requires active management of growth, balancing the tension between standardization and flexibility through gateways (Hanseth, 2001) and flexible standardizations (Braa et al., 2007). This process would be neither spontaneous, nor quick. Thus, it requires a mid-long term view and support which goes beyond current fragmentation. Scaling up need to address both "the what" and "the how" (Sahay and Walsham, 2006; Braa et al., 2006). For example, PHIS scaled within countries by extending to facility level, and increasing in terms of functionality with the use of gateways. The complexity which emerges from the interplay within and between the previously introduced levels of federation, requires infrastructural change in an incremental fashion.

Networks of action, on the base of knowledge about the evolution of infrastructure, can be the corresponding organizational "posture" finding synergies and creating federations between software, health care initiatives, and involved organizations. Building on the top of what is already there, has advantages (Braa et al., 2007), as it:

- Re-orders and orients existing and other resources
- Does not clash with the local "installed base"
- Is more likely to meet local needs
- Allows the coordination of fragmented initiatives, improving results and saving resources
- Relies on a modular strategy of alliances rather than a rigid organization (hard to establish, maintain and change)

6. RECOMMENDATIONS

The paper has outlined the reasons for advocating a federative approach to health information infrastructure. We encourage the revision of e-health development strategies in order to conceive themselves as potential parts of larger networks, possibly included in or converging into a broader infrastructure. Design and implementations have to be organized accordingly. Thinking about ongoing e-health systems as dots to be connected for future health information infrastructure is our general recommendation, strengthening South-South networks. Differences in the approach used in building health information infrastructures in the South can affect the sustainability and the scaling up of the network. A federative approach is recommended, having weighed the limitations and potential shortcomings of cathedral and bazaar approaches (Raymond, 1997). In

the era of globalization, when health issues are decreasingly bounded by national borders, having uncoordinated e-health initiatives is a problem for all, not only for specific countries. Having a good balance of the possibilities and limitations of both technology and politics, as expressed by Bannister and Walsh (2002), is crucial. More specifically, in developing the south-south networks, all stakeholders should avoid mere transfer of technology, and actively engage in adopting and transforming the initiatives, to evade design mismatch problems (Heeks, 2006).

Practical foci can be:

- supporting globally distributed developer and user communities (of practice)
- harmonizing systems for reporting of health care data to local administrations, ministries and international organizations. These systems can be linked into national international health information infrastructures to support monitoring and evaluation for the governance of the health care at different levels in various countries
- development of standards (of data, indicators, data collection instruments, and work practices) that are effective within local, regional and global environments
- integration of various kinds of datasets (maps, routine reports, program specific, population, infrastructure etc) to reduce some of the existing fragmentation, and provide tools for macro-regions and cross-country interchanges, in order to gain synergies and make visible situations previously invisible or purposefully hidden
- identification and fostering of research initiatives and good e-governance practices at the local, regional and global level to improve dependability, quality of service, maintainability and affordability.

The base for these recommendations lies in recognizing the importance of the “installed base”, of what is already being done and in place. As socio-technical federations can be used to affect -if not to manage- the installed base, we need to find a balance between the need to enable virtuous circles, and avoid the propagation of negative side effects across a growing network. Being more specific about the strategies for federating systems, we recommend a selective integration which identifies specific elements to integrate across systems and places. This posture implies a strategy of modular alliances between all organizations somewhat involved in the systems identified for integration. For example, existing problems in particular systems should not propagate from the local to the infrastructural level, because risks will escalate as a consequence (Hanseth, 2007).

These strategies can be enacted by focusing on the following factors:

1. Established initiatives should be documented to enable smooth handovers
2. Mapping existing initiatives in African countries (and elsewhere as far as those solutions can be implemented in Africa)

3. The negotiation and provision of guidelines for those who are starting new initiatives, and want to avoid being locked out after some time in their activity development
4. Actively fostering coordination of organizational and technical matters
5. Facilitating the federation of complementary technologies and initiatives
6. Establishing mixed public-private transnational consortia
7. Aiming at an independent and authoritative forum for socio-technical negotiations

We propose that federation is an infrastructural means with which a transnational health care field in Africa can reach the critical mass required for sustainable dynamics of cooperation and competition.

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MODELS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) USE IN AGRICULTURE: CASE STUDIES FROM DEVELOPING COUNTRIES

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Abstract

With the advent of ICT use in agriculture, a number of models have been proposed and used with different ICT initiatives to support them. In this study, we discuss different non-econometric models applicable to agriculture in developing countries. This study proposes an econometric model of ICT use in agriculture based on identified factors that influence the use of ICT by farmers and farm employees in the context of developing countries. The proposed model is derived mainly from agricultural practice in South Africa. The model variables that are predicted to have influence on ICT use in agriculture by farmers and farm employees are grouped under 5 categories namely, farmer/farm employee demographics, farm and farmer characteristics, managerial variables, ICT related variables, and perception and attitudes. Modelling ICT use in agriculture will help to identify factors that can be taken into consideration by policymakers and service providers who work with commercial farmers. The scope of the study reported in this paper is limited to determining the general structure or expressive form of the econometric model. An exact expression of the model and the results will be ascertained in a later study.

Keywords: models, ICT use, agriculture, developing countries

1. Introduction

A number of non-econometric models on ICT use in agriculture have been proposed and used in developing countries. However, we are not aware of any econometric models on ICT use in agriculture that have been established yet. Therefore, the objective of this study is to identify the different ICT non-econometric models used in agriculture and then propose an econometric model that can be used in the same field. We report our effort to model the use of ICT in agriculture in a developing country context.

Modelling ICT use in agriculture will help to identify factors that can be taken into consideration by stakeholders and service providers who work with farmers in agriculture. This will help them to find possible solutions to the problems and challenges faced by farmers and to meet their specific needs. This study will also provide basic information for further research on ICT-driven agricultural development. It will act as a benchmark for similar ICT use studies targeting agricultural communities. The research will contribute to the development of a future

comprehensive agricultural portal for developing countries especially in Africa. The results of the study will enable researchers, policymakers and other interested parties to understand the ICT needs of agricultural communities in developing countries. The identified factors of ICT use will contribute to the development of a relevant ICT-driven agriculture model that can be used for agricultural development purposes. Knowledge of these use factors can also contribute towards the shaping of government policy on agricultural development.

This study focuses on the use, not the broader issues of adoption, of ICT in agriculture. The suggested model tests whether a farm owner or farm employee is likely to use certain ICT for farm operations. The proposed model does not ascertain the exact probability or livelihood value. The term farm owners and farmers will be used interchangeably. In this study, farm owners will be defined as those who actually own the farms or anyone acting and making decisions on their behalf (manager). Furthermore, the scope of the study reported in this paper is limited to determining the general structure or expressive form of the econometric model. An exact expression of the model will be ascertained in a later study.

The rest of the paper is organized as follows: Section 2 discusses the relevant literature on non-econometric models of ICT use in agriculture. Section 3 presents the econometric modelling of ICT use in agriculture. The proposed model is presented and explained in detail in section 4. The paper concludes in section 5.

2. Non-Econometric models of ICT Use in Agriculture

A model is a simplified version of a complex process or system used as a way of analysing and solving problems or making predictions. Mainly ICT models used in agriculture are proposed to solve problems of lack of information, be it on agricultural technologies, natural resource base and geography, policy environment, laws and regulations and market information. According to Mrayati [1] ICT models have initiatives that support them in order to meet the different needs of the community. An initiative is a plan or strategy aimed at tackling a particular problem or situation.

A number of models of ICT use in agriculture have been proposed and used in different countries. Table 2 shows a summary of ICT models, initiatives under them and examples of agricultural communities in developing countries using those models.

Table 2: Models of ICT use in agriculture

Model	Initiatives	Examples
Rural Connectivity model	-Digital villages -E-municipality	-Village pay phones (Bangladesh) -Digital Village (South Africa)
Community-based content model	-Multipurpose information centres -Telecentres -Village information shops -Rural radios	-Mamelodi (South Africa), -Nakaseke (Uganda), -Kothmale (Sri Lanka), -Talking farming (Zimbabwe)
Virtual business incubator model	-Professional trading networks -Local business information systems and portals -Employment portals -Community financing	- ISAP (India) -B2Bpricenow.com (Philippines) -Electronic farm manager (Zimbabwe) -E-choupal (India)
Community empowerment and participation model	-Government services to isolated communities	-Madhya Pradesh (India)
Community vocational training model	-Technical and vocational training	-Vocational training centres (Zimbabwe)

Adapted from Mrayati [1]

Most of the models shown on Table 2 are being used in many developing countries. The models that find most use are the community-based content model and the virtual business incubator model. For example the telecentre approach has been widely used in Africa. Telecentres are established as information resources and communication nodes in communities to meet the information needs of the people. They offer a broad range of communication services for free or on subsidies from governments or non-governmental organisations [2]. In South Africa, the government established telecentres as a way of placing ICT and other information services within

the reach of disadvantaged rural South African communities [3]. About 103 telecentres have been established throughout different provinces in the country, and examples of successful telecentres include Mamelodi and Gaseleka. Services provided by Mamelodi telecentre are driven not by technology but by real needs of communities [4]. In Uganda, Nakaseke Multipurpose Telecentre has been among the successful telecentres. It helps farmers through creation of some educational videos on issues such as agriculture practices [2]. The telecentre have made a great difference due to its commitment to gender and women. It has managed to develop relevant and local agriculture-related content for use by the local people [5]. The telecentre approach has been embraced in many countries, including Uganda, Kenya, Senegal and South Africa.

Besides telecentres, the rural radio approach has been so popular in disseminating agricultural information across long distances and rural remote places. One example of a successful initiative is the Kothmale community radio and Internet in Sri Lanka [6]. The initiative integrates community awareness, skills, capacity, public access and local appropriate content specifically for a rural set up. It has assisted the rural people to benefit from ICT. In Zimbabwe, the government has used radio and television in educating farmers using three main languages through a program called 'talking farming' [7]. The programme is broadcast live and offer question and answer sessions. It has been successful in disseminating agricultural information to agricultural role players and a lot of farmers gained relevant knowledge on agricultural practices on different farm enterprises.

The Virtual business incubator model has initiatives which have been so popular in disseminating agricultural information to farmers. Information about markets, prices, best practices, finances and weather is disseminated through electronic business portals. For example, in India and South Asian Association for Regional Cooperation countries, a network of professionals called Indian Society of Agribusiness Professionals was formed to serve farmers, small rural entrepreneurs and agricultural graduates [8]. The professionals specialise in the provision of information through meetings, e-mails, seminars, workshops, SMS, website and telephones to provide services which pertains to irrigation, food processing, international trade, research, and agricultural extension. According to Singh [9], this network is probably the largest agriculture and rural development professional network in the world. It has a membership of over 9000 members, 400 NGO partners, and 110,000 farmers. It has been able to provide answers to over 3000 queries and problems raised by the farming community.

Paul, Katz and Gallagher [10] acknowledge that ICT for agricultural development have been successful in Jamaica and Philippines. Muturi [11] also confirms that Jamaica has set an impressive standard for other Caribbean countries, in terms of its support, implementation and applications of ICT for national development and public service delivery. In central Jamaica, the Central and Satellite Agricultural Information Centre, provide farmers with accurate and up-to-date agricultural information to enhance access to market by poor people.

In Philippines, an e-marketplace (B2Bpricenow.com) was established to enables farmers, fishermen, and small and medium enterprises to access market prices and trade products. The marketplace can be accessed via web site or cell phone and it has online trading and payment options and its services are provided free of charge. It provides free market place and an electronic bulletin where farmers could get market information directly. These facilities helped the farmers to know prevailing prices, increase their negotiation power and minimise costs of intermediation in the supply chain. Lower transaction costs are gained and broader access to global market is promoted [12].

A farming logistics programme called e-Hurudza/Electronic farm manager was developed by a local company to address farmers in three main languages in Zimbabwe. The e-Hurudza/Electronic Farm Manager software enable farmers to access information on crop and livestock cycles, rotations, relevant input requirements and applications, tracking input prices, farm administration including financial reports, marketing and sales [13]. From this program a number of successful farmers have been able to (i) inquire and understand how to grow commercial crops, their varieties, disease control and chemical application; (ii) get advise on the most suitable crop for the region the farmer is situated according to the soil type and rainfall pattern; (iii) receive basic and intensive instructions on how and where to grow /rear a particular crop/livestock and (iv) capture input prices which are continuously updated to enable the farmer make informed decisions when preparing a budget.

It seems some countries invest more in some models than the others, depending on the needs of their agricultural communities. Fewer developing countries invest in community empowerment and participation models and community vocational training models. More are interested in community-based content models and rural connectivity and virtual business incubator models. However, for ICT models to be successful there are a number of issues to be considered. One of them is the need for models to target different elements like community awareness, skills capacity, public access, empowerment and locally appropriate content. An integrated approach of

these elements is very important [6]. Another essential issue is the identification of the problems of agricultural communities and using the appropriate combinations of traditional and modern ICT when implementing the initiatives to support the ICT models [14].

Advantages of non-econometric models: The models discussed above are all non-econometric. Non-econometric models are important as they show how using ICT solves identified problems and needs in agricultural communities. The advantage of non-econometric models lies in their simplicity: easy application, even when data is limited and user-friendliness. With little training the beneficiaries can be able to comprehend what they are taught in implementing the initiatives under each model. In addition, non-econometric models are detailed and easy to understand.

Disadvantages of non-econometric models: However, the major disadvantage is that facts and assumptions of a model cannot be proved statistically, thereby compromising the effectiveness of non-econometric models. In addition, without statistical analysis one cannot get the exact value of a factor or variable. The significant influence of a variable on other variables and their relationship with other variables cannot be predicted using non-econometric models.

3. Econometric Modelling of ICT Use in Agriculture

Given the shortcomings of non-econometric models, econometric models are often preferred. An econometric model is a tool used to replicate and simulate the main mechanisms of a regional, national or international economic system. According to European Commission [27], there are three main purposes for constructing an econometric model. Firstly, an econometric model tests the validity of theoretical relationships between variables and the magnitude of the relationships. It is a way of testing whether a variable has influence on the other variable. Secondly, econometric models can be used for evaluating and assessing the effects of policies. Thirdly, econometric models construct alternative reality and compare the results against the usual baseline models.

Advantages of econometric models: Since without proof, facts do not speak for themselves, econometric models have the advantage of performing statistical tests on various modelling assumptions and they can be used to assess and prove the credibility of the proposed facts. According to Abler [28], econometric models permit the researcher to make varied and explicit assumptions. Assuming that there is real data and the study is methodically sound, econometric models produce real results. Using econometric models gives the exact value of a variable or

factor and assesses if there is significant influence of that variable on other variables. Econometric models also provide an opportunity to learn from recent economic history. Additionally, they can be modified to suit changing reality. Furthermore, the fact that econometric models are informed by economic theory, which specifies the variables that are important and the causal relationship among them, proves that econometric models are viable.

Relevance of econometric models: Econometric modelling is very important because the statistical results help to explain the reasons behind a proposed assumption or hypothesis. In this study, this will enable us to identify the reasons or factors behind the use of ICT. The results of the study will enable researchers, policymakers, service providers and other stakeholders better understand the ICT needs of agricultural communities in their countries. The identified factors of ICT use will contribute to the development of a relevant ICT-driven agriculture model that can be used for agricultural development purposes. Knowledge of these use factors can also contribute towards the shaping of government policy on agricultural development. Farm owners and managers can use this model to determine if the correct personnel are recruited to use the specialized technologies and to check if certain technologies are suitable for their farm operations.

Disadvantages of econometric models: Among other things, the major shortcomings of econometric models include the reliance on hypothesis that can only be supported by data. This entails the need for large data sets and a lot of data gathering. Also, econometric models need expertise to develop them. They also require forecasting of variables and are not always the best forecasting technique. They also have problems in predicting outside of the range of currently observed time frame. Besides, results from econometric models are historical in nature and may no longer be relevant [28]. As long as there is awareness of these disadvantages, their negative impact, or drawback, can be mitigated through conscious and purposeful effort. Thus, these disadvantages notwithstanding, economic models can be powerful and effective tools for the improvement of agriculture.

However, we are not aware of any existing econometric models on ICT use in agriculture. In this study therefore, we propose an econometric model that shows the factors influencing the use of ICT in agriculture. The closest econometric model we found was on the use of ICT in health delivery system [15]. The author investigated the use of ICT in health service delivery in Namibia. There are similarities and differences between our model and what Shivute [15] proposed. Both studies identify the factors influencing ICT use and investigate the likelihood of ICT use, although the details of each model differ. The data analysis methods are similar, in terms

of the use of descriptive statistics, multinomial regression model and logistic regression model to identify the factors affecting the use of ICT. Some independent variables such as age, education level, income and ICT affordability are also similar.

There are essential differences between the two studies. One of them is on the ICT that are investigated. In this study we investigate ICT used in agriculture that are different from ICT that can be used in health system. Shivute's model shows what is actually happening in the Namibian healthy service delivery system, while our model is predictive. Lastly, our model uses correlation analysis to find the relationship between the variables and chi-square test to identify the differences in ICT use between the different stages of the supply chain and the differences within each stage of the supply chain. This is not applied in Shivute's model; instead the author uses factor analysis to classify the technologies into three groups. In order to develop our econometric model we identified factors that influence the use of ICT in agriculture. These are reviewed in the next section.

3.1 Factors affecting the use of ICT in agriculture

Less research has been done on factors affecting the use of ICT in agricultural sectors of developing countries. The studies cited in this section were undertaken in developed countries like Canada, United State of America and United Kingdom. In South Africa, few scholars have investigated this issue. An example is Woodburn, Ortmann & Levin [16] who specifically investigated the factors influencing computer use by commercial farmers. Basically, there are few reports investigating the use of other information and communication technologies in agriculture.

The technology acceptance model (TAM) suggests that there are a number of factors that influence the adoption and use of technology. These are external factors, perceived usefulness and perceived ease of use. Perceived usefulness is the degree to which using technology would improve performance and perceived ease-of-use is the degree to which using technology is expected to be effortless [26]. In agriculture, the use of ICT can be influenced by a number of different factors, such as type of farm enterprise, farmer's permanent characteristics, farm characteristics, goals and community culture [17]. These factors have direct and indirect relationships and influence the use of ICT either positively or negatively. In businesses, the use of ICT also depends on the perceived value of ICT [17]. Results of previous studies reported on South Africa [16] and on Canada [18] show that certain characteristics of farmers such as education, age and off-farm work, farm size and gender are also important variables in explaining

the use of computers. Taken together, some of the factors identified in previous studies are as follows:

Age: The age of the farmer can be negatively related to the use of ICT and the probability of ICT use decreases with increasing age. The younger the farmer, the more likely is the use of ICT.

Farm size: The size of the farm has a positive relationship with the ICT uptake. Larger farms tend to be earlier users of technology than smaller farms [19].

Education: Use of technology is believed to be positively associated with education [18]. Those farmers with post-high school qualification tend to make up the majority of ICT users.

Off-farm income: Farmers with off-farm income are likely to use ICT than those in full time farming [17]. The probability of ICT use increases if the farmer has off-farm employment.

Gender: The probability of use increases if the farmer is female [18].

Barriers to ICT use: The anticipated barriers to ICT use such as lack of ICT training, high technology costs, lack of technical know-how and lack of education affect ICT use negatively. The higher these barriers are, the smaller the probability of ICT use.

Farming experience: The farmer's experience in agriculture has a positive relationship with ICT use. Those farmers with more farming experience tend to use technology than those with less experience [20].

Income: Those with less annual /monthly income are often the ones with the least access to ICT. The higher the income levels, the higher the probabilities of ICT use.

Distance from centre of development: Those located close to the centres of development have greater access and use for ICT than those far away [21].

Household size: A large household size is generally associated with a positive influence on ICT use than a smaller household size.

Attitude: Positive attitude towards ICT implies a positive effect on ICT use and a negative attitude implies otherwise [22].

Outlining the factors that were identified by other related studies contributes to the development of a model for ICT use in agriculture.

3.2 Theoretical model underpinning the study

Since this study is interested in investigating the factors that determine the use of ICT, it will employ the information innovation adoption model to explain farmers and farm employee ICT use behaviour. It is the best existing model we can find to explain ICT use in agriculture. The model uses behavioural modeling concepts proposed by Kline [29] and uses mediating variables

to assess the relationships. It was developed, adopted and used by Alvarez and Nuthall [30] to investigate the use of computer based information systems by dairy farmers in Canterbury, NZ and Florida, Uruguay. The model is shown diagrammatically in Figure 3.2.

See Appendix 2

The model shows that the use of computers by farmers relies on certain variables and that the relationship among the variables is not a simple direct one. The first group of variables is composed of antecedent variables that are indicated by circles in Figure 3.2. An antecedent variable is an underlying cause for a situation or scenario. In this model, the variables include farmer/employee's permanent characteristics such as age, personality, formal education and income; farm characteristics such as farm size and crops grown on the farm, and farm/employee perceptions and attitude. The second group of variables includes mediating variables indicated by rectangles in Figure 3.2. Mediating variables are variables that describe how, rather than when, effects will occur by accounting for the relationship between the independent and dependent variables. Mediating variables are introduced to explain why an antecedent variable affects the outcome variable. In essence, they moderate the influence of antecedent variables on the outcome variable. Examples are coping styles of farmers, use of ICT in decision-making, information management style, and objectives and goals pertaining to ICT.

According to Alvarez and Nuthall [30], the model assumes that there are direct and indirect relationships between the antecedent and outcome variables. The reversible arrows on the antecedent variables indicate a two-way relationship between the variables. One variable may affect the other either positively or negatively, and vice versa. For example, education, as an independent variable, may not be acting alone, but maybe interacting with farm characteristics and/or with elements of community culture. One-way arrows indicate the relationship between the antecedent and the mediating variables, with the mediating variables explaining the relationship between the antecedent variables and the final outcome variable. Each antecedent variable may affect the mediating variable negatively or positively. For example, the farmer's education may affect the farmer's objective, management style and the ultimate use of ICT.

All these variables influence the final outcome variable, which is the use of ICT represented by the octagon in Figure 3.2. Basically all these three groups of variables are being investigated in this study. In the data collection instrument there are relevant questions asked about these variables. The data collection instrument is beyond the scope of this paper, and as such is not

reported here. The factors discussed in this section and other possible factors can be analysed to propose hypothesised econometric model. We attempt this in the next section.

4. Econometric Modelling Framework

From the foregoing discussion, it is seen that a number of factors influence ICT use in agriculture. In the proposed model, these are defined as modelling variables. In the model, the independent variables fall under five categories that are hypothesized to influence the use of ICT in agriculture. This is shown diagrammatically in Figure 4. As can be seen in the figure, statistical modelling techniques (which are discussed later) are applied to the independent variables to determine a suitable indicator for ICT use in agriculture.

As already noted, the proposed model in this paper is derived from agricultural practice in South Africa, mainly because its demographics, the ICT profile of its farmers and other ICT related variables more closely resemble those of other developing countries.

See Appendix 3

4.1 Variables

Table 4.1 illustrates the list of variables (and their predicted signs) that are hypothesised to have influence on ICT use in agriculture by farm owners and farm employees. In this framework, both the farm owners and the farm employees are included as respondents, because leaving one of these two would give us inadequate information about their use of ICT. For ICT use in agriculture to be successful both the farm owners and farm employees must be willing and able to use ICT in their day-to-day agricultural operations. Farm owners make decisions on the type of employees to employ and the appropriate ICT suitable for their farm configuration. On the other hand, the farm employees are there to execute what the farm owner proposes. The fact that on a farm setting, the farm employees do much of the work justifies the use of ICT by farm employees in some of their daily operations. This study will help the farm owners and managers to determine if the correct personnel are recruited to use the specialized technologies. Also there is need to check if the farm employees are getting the benefits of the proposed ICT they use on their day-to-day operations. Above that, with the ongoing Agricultural Black Economic Empowerment (Agri-BEE) it may be necessary to investigate how farm employees are empowered by their employers. Excluding

either the farm owner or farm employee in the study would mean that some essential information would be missing.

Table 4.1: List of variables for ICT use and their predicted signs

Variable	Description	Type of measure	Expected sign	
Dependent variables				
ICTUSE	Whether farmer/employee use ICT or not	[1]=yes, [0]=no		
Independent variables				
			Farm owners	Farm employees
Demographics				
AGE	Age of farmer/employee	Years	-	-
INC	Income per month/year	Rands	+	+
OFFINC	Off-farm income	[1]=yes, [0]=no	+	
EDUC	Education level	Years	+	+
HHSIZE	Household size	Numeric		+
AGRIC	Agricultural qualification	[1]= yes, [0] = no	+	+
GENDER	Gender	[1]=male, [0]=female		-
EMPLMT	Nature of work contract	[1]=permanent, [0]=seasonal		
RACE	Race	[1]=black,[2]=coloured, [3]=white	+	-
Farm & farmer characteristics				
DIST	Distance from town	Hours	+	-
ENTTYPE	Type of farm	[1]=dairy,[2]=fruit,[3]	+	

	enterprise	=field crop [4]=livestock		
MEM	Cooperative membership	[1]=yes, [0]=no	-	
EXP	Farm experience	Years	-	+
FSIZE	Farm size	Hectares	+	
Managerial variables				
EXP	Farm experience	Years	-	+
MKT	Market	[1]=yes, [2]=no	+	
MGT	Managerial position	[1]=yes, [0]=no		+
ICT related variables				
GOAL	Farmer/employee ICT goal	[1]=yes, [0]=no	+	+
ICTLIT	Employee ICT literacy	Count		+
TRAIN	Employee ICT training	[1]=yes, [0]=no		+
Perceptions and attitude				
ATTI	Farmer/employee attitude towards ICT	[1]=positive, [0]=negative	+	+
BEE	Employee/farmer attitude towards black empowerment	[1]=positive, [0]=negative	+	+
AFFOD	Affordability of ICT	[1]=yes, [0]=no	-	-

(+) Positive association with ICT use

(-) Negative association with ICT use

4.1.1 Independent variables: The 23 potential independent variables fall under 5 categories, namely, farmer/farm employee demographics, farm and farmer characteristics, managerial variables, ICT related variables, and perception and attitudes. The predicted signs on the independent variables indicate whether they are likely to affect the dependent variable (ICTUSE) positively or negatively. Some factors that influence use of ICT by farm owners may not be

necessarily the same as those that influence the use of ICT by farm employees. Even if some of the factors are the same, they may have different relationships with ICT use.

The independent variables included in the model are derived from previous related studies on ICT use in agriculture, which identify them as the most significant factors, and from other studies on ICT adoption [16; 18]. Some of the variables have not been identified in any previous studies, but they are anticipated to make economic sense when related to ICT use. The market was also included because most of the farmers export some, if not all, of their produce to overseas markets. There are a number of aspects that are relevant and applicable for developing countries but may not be relevant to developed countries in the proposed model. For example, BEE is an important aspect for developing countries like South Africa because it was initiated to allow the black majority to participate fully in the economic development of their countries [23]. It is used as an affirmative action mechanism to resolve racial differences and imbalances stemming from the colonial antecedent of apartheid in most African countries. It is likely that most blacks will welcome the initiative and empower themselves through, among other things, using ICT to be actively involved in the economy. Race is another important variable relevant to developing countries. This variable measures if there is a change before and after independence in the ownership and management of resources on farms. Before independence most agricultural sectors were dominated by the colonisers, mainly whites. The situation slowly changed after independence. Another factor that is peculiar to developing countries is that of affordability of ICT. In Africa, it is still a great challenge, especially for the black majority. It is therefore important to investigate if differences in ICT affordability have significant impacts on its use. Some demographics apply even to developed countries, although the interpretations may be different from those of developing countries.

4.1.2 Dependent variable: Use is usually defined in terms of a binary variable. In this case, ICTUSE is the dependent variable Y and is defined as a binary variable with a value of 1 and 0. For farm employees, Y has a value of 1 when farm employees are likely to use ICT and 0 when not likely to use ICT. In case of farm owners, Y has a value of 1 indicating the suitability of a set of ICT for the farm operations and 0 for the non-suitability of a set of ICT for the farm operations. Table 4.1.2 shows the interpretation of Y value for farm employees and farm owners.

Table 4.1.2: Interpretation of Y value for farm employees and farm owners

Type of user	Y- Value	Interpretation and meaning of Y-value
Farm employees	0	Is likely not to use ICT
	1	Likely to use ICT
Farm owners/farmers	0	ICT not suitable for farm operations
	1	ICT suitable for farm operations

4.2. General Form of Econometric Models

A set of equations that depict real economic sense can be used to express the relationships among the variables and predict the effects of each variable on the dependent variable. The general form of the equations is the same for both farm owners and farm employees, but the independent variables are different. The generalised equations are applicable to ICT use in agriculture in developing countries, particularly South Africa. Our investigation leads us to surmise that the independent variables are essentially orthogonal, or independent, of one another. Similar relationships have been found to exist in the use of computers and other information and communication technologies by farmers [25; 18], in the dairy industry [17] and in the health industry [15]. Therefore, the hypothesized general format of the econometric models is as follows:

Econometric model 1: farm owners

$$Y_{FO} = B_0 + B_1AGE + B_2INC + B_3EDUC + B_4AGRIC + B_5RACE + B_6DIST + B_7ENTTYPE + B_8FSIZE + B_9EXP + B_{10}MEM + B_{11}GOAL + B_{12}OFFINC + B_{13}MKT + B_{14}ATTI + B_{15}BEE + B_{16}AFFOD + \epsilon_0$$

Where:

Y_{FO} = Use of ICT by the farm owner (A binary value. 1 if ICT is suitable for farm operations, 0 if otherwise)

B_0 = Constant

B_1 - B_{16} = Coefficients

ϵ_0 = Error term

Econometric model 2: farm employees

$$Y_{FW} = \alpha_0 + \alpha_1AGE + \alpha_2INC + \alpha_3EDUC + \alpha_4HHSIZE + \alpha_5AGRIC + \alpha_6RACE + \alpha_7DIST + \alpha_8EXP + \alpha_9MGT + \alpha_{10}GOAL + \alpha_{11}ICTLIT + \alpha_{12}GENDER + \alpha_{13}TRAIN + \alpha_{14}EMPLMT + \alpha_{15}ATTI + \alpha_{16}BEE + \alpha_{17}AFFOD + \epsilon_1$$

Where:

Y_{FW} =Use of ICT by the farm employee (A binary value. 1 if farm employee is likely to use ICT, 0 if otherwise)

α_0 = Constant

α_1 - α_{17} = Coefficients

ϵ_1 = Error term

4.2.1 Statistical Experiment

To determine the exact final form of the econometric expression of the proposed models, a set of statistical analysis techniques need to be specified on a data set collected from the field.

Correlation analysis will be used to find the relationship between the variables and chi-square test will identify the differences in ICT use between the different stages of the supply chain and the differences within each stage of the supply chain. Multinomial regression model will be used to identify significant factors affecting multiple ICT use by farm owners and employees. Logistic regression model will be used to analyse the relationship between one dependent variable and more than one or multiple independent variables [24]. Logistic regression modelling will also be used to identify factors affecting the use of individual ICT. A different model will be run for the farm owners and employees to examine the factors that determine the use of each individual ICT. Logistic regression is more appropriate than linear regression for this analysis because the dependent/outcome variable is binary. Depending on the significance levels found, some of the independent variables may vanish from the model expression.

4.2.2 Data

Two sets of data will be collected. The first set on the farm employees will probe types of ICT used, factors influencing ICT access, ICT literacy and training, perceptions and attitudes towards ICT. The set for farm owners will address issues of production, asset and input procurement, communication, ICT types used, challenges of ICT use and role of ICT in marketing.

The type of statistical experiment for this study requires stratified random sampling in order to get the true indicator of the use of ICT in the agricultural sector. To improve the representativeness of the sample by reducing sampling error, it is necessary to apply random sampling to each stratum. This method will need to be applied to both the farm owners and farm employees.

5. Conclusion

The main aim of ICT in agriculture is to provide information to farmers and all stakeholders and help them to make informed decisions throughout the year. Policy makers and stakeholders will only develop better service delivery when they have an appropriate model showing a true indicator for what is happening in the field of agriculture. In this paper therefore, we worked towards the development of this model. However, there is need to conduct statistical experiments to validate the predictions suggested in this paper. The results of the experiment will provide a better picture of the effects of each variable on ICT use. We have already begun this extension of the study.

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Examining institutional interventions: the case of electronic voters' registration in Nigeria

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ABSTRACT

The Independent National Electoral Commission (INEC) is one of several organizations sponsored by the Nigerian government as part of its e-government initiative to computerize all ministries and its mission to increase the level of adoption and diffusion of ICTs in the country. This strategy may be attributed to publications suggesting a link between ICTs and development, which is prompting the introduction of various information systems within different governmental organizations and fuelling the relentless efforts at promoting them. Research has highlighted the role of institutions in the adoption and diffusion of ICTs. We draw upon one such framework to examine two efforts by the Commission (INEC) to introduce an Electronic Voters' Registration system. This system was designed to provide a more credible electoral process with a view to increasing the participation of the citizens of the country in future voting exercises, hence aiding its adoption as the status quo. However, despite a number of interventions promoting the innovation, these efforts failed to institutionalize the system, which was poorly perceived after the elections amidst reports of high levels of electoral malpractice. We conclude by reflecting on the limitations in this context of institutional interventions and suggest some implications for policy makers.

INTRODUCTION

The aim of this paper is to explore the issues affecting the adoption and diffusion of information systems (IS) in the context of developing countries. One of the main reasons for pursuing research in this area is the identification of a link between information and communication technologies (ICTs) and development. Some arguments suggest that ICTs will produce development effects through the operation of market mechanisms (for example, UNDP 2001). Others suggest that such a view neglects the important role of institutions other than the market (Avgerou 2003), the different meanings that may be attached to development (Walsham et al. 2007) and the need to understand the context that matters in any development effort (Avgerou 2008). The number of instances of partial or complete failure of IS in developing countries (ISDC) (Avgerou and Walsham 2000; Walsham et al. 2007) lends support to the latter view. Notwithstanding, DCs have persevered with the continuous introduction of, and reliance on, ICTs for their programmes and services, often inspired by the publications of international development agencies suggesting scope to 'catch up' or 'leapfrog' the developed countries. In short, how ICTs can benefit development and the dynamics of the processes through which this may be achieved is a complex and important area which merits further research.

In their forward to the special issue on ISDC in *MIS Quarterly*, Walsham et al. (2007) argue for the need to move beyond a technological change perspective to study the shifts in social, political and cultural contexts and the wide range of actors and institutions involved in development efforts. Institutional theory and its derivatives have been proffered as a means of understanding these dynamics (Avgerou 2002; Bada 2000; Miscione 2007; Silva and Figueroa 2002). Such research acknowledges the forces that influence the adoption and diffusion of ICTs in DCs and the processes through which local adaptation and cultivation of IS might occur. Our research is oriented towards the former goal. To that end, we employ a framework that examines the role of institutions in the adoption of IT innovations (King et al. 1994). Without contemplating validation (or the lack thereof) of the use of ICTs for development, we believe that such an investigation can be of substantial benefit because insights may be gained which would lead to more successful IS implementations and better efforts at fostering conditions for the usage and adoption of ICTs. We adopt a case study approach which focuses on a voter registration system in Nigeria by analysing the associated IS programme and the mechanisms it employed in its efforts to institutionalize the innovation. In exploring the issues affecting adoption and diffusion of information systems, the main question we seek to investigate is: *To what extent are institutional interventions sufficient in promoting the adoption and diffusion of information systems in developing countries?*

It is constructive to view issues in this way because it enables a consideration of local contexts to the introduction of information systems. Indeed, Silva and Figueroa (2002) call for indigenous research where it is expected that the concepts of development should come from the people and institutions of developing countries and not the westernized nations. Also, in challenging the rationalities of modernity, Avgerou (2000) states that many of the widely known problems of developing countries are constituted within the western societies' experience of modernity. She advocates the need for alternative courses of rational action which are manifested in IS projects in developing countries for better interpretation of the situations.

The remainder of this paper is organized as follows. The next section presents a critical review of the existing literature within the area of ISDC and introduces the framework that informs our analysis of the case. The following section describes our research methodology and highlights some of the difficulties encountered during the research study and the measures taken to address them. Next, we present the case study narrative followed by our conceptual analysis. Finally, we present conclusions from our study and implications for research and practice.

LITERATURE REVIEW

This section examines the rationale for ICTs as an instrument for development, why it is being advocated and by whom. Following this we provide some examples of the use of ICTs in a developing country context and then focus on the role of institutions in the adoption and diffusion of IS.

ICTs and Development

It is typical of developing countries to acknowledge and therefore commit to the use of ICTs in the delivery of improved services. This attitude stems from a belief in the capability of these technologies to bring to the public sector benefits such as improved planning and monitoring mechanisms, cost savings through rationalization, and more effective administration (Gasco 2003; Madon 2004). Further claims rest on the ability of ICTs to reach a larger number of citizens especially people in rural areas, which would produce other beneficial effects such as providing them with vital information to help them to make a living through entrepreneurial activities, thereby eradicating poverty (Madon 2004).

Another contributor to the increasing dependence on ICTs by governments in developing countries is the focus on programmes of international agencies such as DfID (Department for International Development), G-8, UNDP (United Nations Development Programme) and the World Bank. These agencies promote links between ICTs and development under the banners of 'E-governance for Development', 'Technology for Development', etc. and often provide sponsorships for such initiatives. As a consequence, DCs may believe they are deprived of the opportunities for economic growth and social development because they experience a scarcity of ICTs (Avgerou 2007).

However, there are flaws with the 'IT-for-Development' concept. The impact of IT on development is hard to evaluate. Madon (2004) argues that evaluation guidelines tend to focus on the supply-side benefits of ICT infrastructure while ignoring demand-side considerations, i.e. actual benefits to the communities. Also, there is conflict within the notion of development itself. The discourse shows perceptions of development varying between social welfare in terms of people's basic needs (Little 2003) and capabilities in terms of the achievement of an individual's most desired needs by choice (Sen 1999).

IT Innovations in Developing Countries

Health and education are high priorities for individuals and their governments. IT innovations have been prominent in these contexts in developing as well as developed countries. Issues pertinent to the adoption and diffusion of such technologies relate to their sustainability and scalability. In the health sector, Braa and colleagues have contributed over many years to an action research programme concerned with the development and implementation of health information systems in Africa, Asia and Latin America (Braa et al. 2007; Braa et al. 2004). They identified the need to secure the required financial and knowledge resources and continued political commitment as key institutional factors sustaining the innovations. Similarly, Sahay and Walsham (2006) investigated health information systems in India and found human resources capacity and waning political support as key issues affecting scalability of the innovations. In an education context, some researchers have explained the adoption of ICTs in terms of their economic developmental potential (Mbarika et al. 2007), while others have elaborated the argument to include both health and education (Ngwenyama et al. 2006).

In a public administration context, research suggests that when citizens lack confidence in democratic institutions their propensity to cooperate is reduced, causing obstacles to programmes/government initiatives intended to foster economic growth (Avgerou 2007). Increasingly, then, ICTs are being implicated in governance relationships as governments place greater reliance on IT innovations as means to advance their policies and agendas. Indeed, Gasco (2003) argues that even though governments' primary objective in using IT is to improve administrative efficiency, other effects are produced that give rise to increased transparency and accountability, and thus bolster a government's relationship with its citizens.

Electronic voting (e-voting) is one such innovation in which governments try to engage citizens' participation in one of the most fundamental statutes in a democratic society. Besides engaging an active population of eligible voters, e-voting is seen as having the potential to bring transparency to governments' activities and decisions, combat the corruption that often plagues electoral activities and enable citizens to participate in an elective process that accurately represents the choices of the electorate (Avgerou 2007).

In the case of e-voting in Brazil (Avgerou 2007), technology was not used to instil trust where it was lacking. Rather, confidence in the electoral process stemmed from two significant factors, namely citizens' positive predispositions towards ICTs and towards the institutions responsible for the elections. In many developing countries, these propositions would not hold. A certain level of IT literacy cannot be assumed and the little IT knowledge citizens possess usually comes from

exposure to ICTs transferred from developed countries. Also, the institutions involved in the electoral process may not have been established long enough to warrant the required disposition. Furthermore, citizens may not distinguish between ICTs in general and voting as an e-government service, nor between institutions involved in the electoral process and the government regime of the day. Thus, while trust in institutions promoting IT innovations may be an important factor influencing citizens to adopt them (Fichman 2000; Gasco 2003; Goodwin 1996), efforts to isolate the sources of such trust may prove difficult, if not impossible, to achieve.

ICTs and Institutional Interventions

Institutions are formally defined as permanent social entities that exert control and influence the conduct of social agents (King et al. 1994). Institutions recognize their potential to influence the perception of citizens (Fichman 2000; Gasco 2003) and do so through various interventions, that is, deliberate strategies (e.g. financial, legislative and sensitization programmes) designed to mobilize support for their services and political agenda. Based on this premise, our research examines the adoption and diffusion of information systems in a developing country (Nigeria) through an analysis of the related institutional interventions designed to promote the innovation. Our specific focus is the implementation of an electronic voters' registration system in the country. The Nigerian government, in collaboration with various international development agencies and local bodies, sponsored the programme. Our aim is to examine the extent to which such interventions were successful, in order to suggest possible courses of action for planners and decision makers involved in formulating and evaluating national IT policies. The dimensions of analysis are derived from the framework developed by King et al. (1994).

The merits in using this approach in the context of a developing country lie in the scope it provides to introduce different concepts of development associated with the introduction of ICTs (Silva and Figueroa 2002). Such concepts include indigenous forms of knowledge (Miscione 2007; Puri 2007) i.e. local discourses of progress and development; and prevailing structures of power in the country (Escobar 1995), as well as issues of culture and identity in the development of national level diffusion strategies (Madon 2000).

Framework for analysis

King et al.'s (1994) framework has already been used to examine the role of institutions in ICT adoption in developing countries from the creation of incentives to the promotion of knowledge resources and expertise (Bada 2000; Montealegre 1999; Silva and Figueroa 2002). This research addresses the need for coherent government policy for IT innovation and a better understanding of

the role of institutions in adoption and diffusion processes. The dimensions for analysis are seen to occur at the intersection between the influence and regulatory powers of institutions and the notions of supply-push and demand-pull. In short, institutions can legislate to create incentives for innovations and promote the availability of knowledge and expertise; these are prerequisites necessary to impact the production and availability of innovations (supply-push) and also to influence prospective users to adopt them (demand-pull).

The authors describe influence as persuasive control of individuals' practices, rules and beliefs exerted through education, systematic articulation of particular view points (propaganda) and partiality in the allocation of resources. Regulation on the other hand is the direct or indirect control of individuals' behaviour through sanctions or other affirmative means. These two dimensions of control form the basis for all forms of institutional action, suggesting the following categories for analysis:

- i. Knowledge building: e.g. funding of research projects to provide a base of scientific and technical knowledge
- ii. Knowledge deployment: e.g. education and training programs for individuals and organizations to fuel the transfer of new knowledge
- iii. Subsidy: e.g. reduction of liabilities for individuals and organizations engaged in innovative activity as support for their endeavours
- iv. Mobilization: e.g. programs for awareness and promotion which encourage positive opinions of an innovation
- v. Standard setting: establishment of standards that restrict the options available to organizations thereby mandating the use of "preferred" products or processes
- vi. Innovation directive: establishment of requirements directing the production or use of particular products.

Research Approach

The categories outlined above guided our data collection process and informed the analysis through which we discuss the events and interventions associated with the case. We adopted an interpretive research approach (Orlikowski and Baroudi 1991; Walsham 1995), in which the aim was to seek rich insight from some key participants rather than generalizations based on statistical significance. Data were collected by the first author three months after the 2007 general elections in Nigeria. At the time, the Independent National Electoral Commission (INEC) was plagued with petitions which required a substantial number of staff to attend the election tribunals set up to respond to allegations of malpractice. In these circumstances some respondents were reluctant to

discuss issues they thought related to election results, for fear of being seen as expressing views that could indict them at the election tribunals.

Data were collected via semi-structured interviews with a range of key players in the electoral process. Despite assurances of confidentiality, some respondents were reluctant to have their conversations tape recorded. Thus, in the interests of obtaining frank opinions, note taking was supplemented for tape recording in some cases. In addition to the interview data, material was gathered from other sources, including websites of the government, the electoral commission (INEC) and external agencies.

The research study was conducted at the headquarters of INEC in Abuja, Nigeria. It involved the following participants:

- i. The ICT director: who was involved with the project on both management and operational levels
- ii. ICT Staff: to explore their views due to direct involvement in the IS implementation
- iii. Voter Registry Staff: to elicit information on work practices pre and post implementation of the IS
- iv. IT Advisor to the Federal Government: to obtain information on the activities of the government regarding ICT policy
- v. Eligible voting citizens: to obtain their perspectives on the system and ascertain impact.

The total number of respondents was twenty-four comprising the ICT director, four ICT staff, four electoral staff, the IT advisor to the federal government and fourteen eligible voting citizens interviewed in pairs. Our approach reflects the time-bound nature of the registration and voting processes. We based our study at the headquarters of INEC since, during the elections, its staff had been temporarily deployed to the polling units across the 36 states of the federation. Thus, we were able to gain an understanding of issues arising in wards across the country. Eligible voting citizens were selected based on principles of convenience and snowball sampling (Bryman 2001). Convenience sampling involves making selections based on opportunity, even if decisions are arbitrary or made in an unstructured manner, while snowball sampling is a specific example of convenience sampling in which contact is made with a small group of people who are then used to make further contacts. Owing to the nature of this study, i.e. a system being used in a political setting, the interviews were expected to provoke heated discussions which may reveal otherwise private political views. Thus, it was necessary to select participants who were willing to be interviewed in such circumstances. Some of the respondents were contacts of the first author who were then used to recruit further participants.

An attempt was made to represent the viewpoints of the different social classes within Nigerian society. Thus, four of the participants were artisans selected from the lower level income earners and semi-literate members of the society. A second group of four were middle income earners with white-collar jobs in banking and other more literate private sector industries. A third group of four were people from the more affluent portion of the society whose opinions have some influence on the decisions of those they have dealings with, directly or otherwise. The final two were active participants of partisan politics, one being a former head of the ruling party and presently a leader of the opposition.

The duration of the interviews was between forty five minutes and one hour. Data were organized in three segments (cf. Oates 2005): (i) those directly relevant to the research focus (as suggested by the framework for analysis); (ii) those providing a broad description of the research context; and (iii) those not directly suggested by the guiding framework. These data informed the case study narrative which is presented in the next section and provides the basis for the analysis that follows.

CASE STUDY NARRATIVE

The first national science and technology policy in Nigeria was formulated in 1986 and has been reviewed by successive governments (FMST 2007a). The policy highlights the government's vision to use cutting-edge technologies to drive socio-economic progress and development. Government services are a key focus, which we address in this paper through the case of an electronic voters' register introduced by the electoral commission of the country.

Elections in Nigeria

Elections have been conducted in Nigeria since 1959, but the political history of the country since then shows successive governments plagued by instability, resulting in a cycle of elected democratic regimes interrupted by periods of military rule (BBC 2007; INEC 2007). In recent years some continuity has been achieved, in which the country moved from military rule to a democratic dispensation in 1999 and onwards to further democratic governments following the elections of 2003 and 2007 (INEC 2007).

Elections in the country have always been a cause for concern with international observers commenting that they are neither free nor fair (BBC 2007). They are often plagued with different types of fraud and electoral malpractice which lead to tribunal hearings and even cancellation.

Electoral commissions are charged with the conduct of elections. In the politically turbulent situation outlined above, these bodies have been regularly dissolved and re-established from 1966 to 1998 when the present one (INEC) was set up. This paper focuses on INEC and specifically its efforts to combat electoral fraud through the use of ICTs in the voter registration process.

The Independent National Electoral Commission (INEC)

INEC was established in 1998 with a mandate to organize all elections in the country, including the registration of voters and political parties; collation and publishing of election results; and the administration and prosecution of all election related matters (COFRN 1999; INEC 2007). Its headquarters is located in the capital city, Abuja, but it has a presence in all 36 states of the federation.

Elections are organized such that eligible citizens are required to register during a period set aside for registration prior to the elections. During these periods, people are required to report at registration units, which are temporary installations set up in residential areas dependent upon the number of people residing there. The units are supervised by INEC staff deployed from either the head office or state offices. Temporary staff are also employed on an ad hoc basis and trained to provide support for the registration activities.

Prior to the introduction of an electronic voters' register, citizens would be asked to give their name, address, date of birth and occupation when registering to vote. Voters' cards would then be issued to the registrants and at the end of the day the lists from each registration unit would be compiled at the headquarters. On election days, registered voters would be required to go to the polling units, set up in a similar fashion to the registration units, where the compiled list of registered voters would be displayed for accreditation. This process required confirming that each card holder was registered on the list for that polling unit. The registrant would then be issued a ballot paper on which to make their mark and cast their vote. At the end of the day all the ballot boxes would be transported to secure locations, where counting would be done. The results would then be sent to the headquarters for approval and publishing.

The major shortcoming of this system was that it failed to create a reusable register. The difficulties associated with paper based systems – i.e. the need to update information in cases of relocation, death and age increments – required the creation of a new register for each election. Furthermore, reports of electoral malpractice were rife, alleging that poll clerks registered fictitious names to increase the voting population in a ward or misplaced portions of the register

to decrease the number. But by far the most significant malpractice was multiple registrations, in which individuals presented to register multiple times at either the same or different units. The more voters' cards they possessed, the more money they would receive from selling their votes. INEC had attempted to tackle multiple registrations in previous elections, by staining registrants' thumbs or forefingers with semi-permanent ink. Although the ink was expected to outlast the registration period and thus prevent individuals from re-presenting for registration, they soon devised ways of washing out the ink stains.

The Electronic Voters' Register

In an effort to reduce electoral fraud, INEC introduced an electronic voters' register for the 2003 and 2007 elections to replace the fully paper based process. A major objective of the system was to have a comprehensive database of eligible voting citizens which would eliminate the need for re-registration at subsequent elections unless the citizen's circumstances changed.

In 2003 the new system involved the use of Optical Mark Reader (OMR) forms. Citizens registered by putting their thumbprints on the forms and shading off their personal details alongside the corresponding alphabets. Forms were then collated within each ward, scanned onto the system and the OMR software transcribed the shaded portions into text for storage in the database. Biometric verification was run within each ward to identify and disqualify multiple registrants. Owing to the high error rate experienced with this system, INEC replaced the OMR forms with direct data capture of registrants' details in 2007. These details were entered directly on to a digital form including thumbprints and photos, providing an opportunity to confirm accuracy of the data before the voters' cards were printed and handed out for on the spot collection. At the end of the registration period, each ward was required to print and display its list of registrants which would be used for verification of voters on election days.

The system was introduced based on the recommendation of IFES (International Foundation for Election Systems), a non profit democracy development organization funded mostly by the US government and contracted by INEC (INEC 2007). IFES has worked on democracies in over a hundred countries worldwide (IFES 2008). The key focus of its work in Nigeria is strengthening the capacity of election administration bodies to ensure credibility in elections and strategic planning for election management. Thus in response to the needs emerging from previous electoral processes, the recommendations of the electoral review team included the reform of the legal framework for elections, election dispute resolution and the system of voters' registration.

Our study revealed two major issues with this computerization effort. First, there was a high level of fraudulent activity within the registration and electoral processes. Thus, numerous disputes had to be resolved in election tribunals and the result was denounced by the European Union and other international observers, who adjudged the elections anything but ‘free and fair’. Second, citizens’ prior experience with electoral processes, coupled with uncertainty about the capabilities of the system and INEC’s ability to implement it successfully, caused scepticism leading to reluctance on their part to participate in the exercise. Furthermore, these issues arose despite a number of institutional interventions that were intended to mobilize support for the system.

Institutional Interventions Supporting the Electronic Voters’ Register

Our research identified different institutions promoting the usage and adoption of the voter registration system and all other activities related to the elections. A Joint Donor Basket Fund (JDBF) was put in place by the United Nations (UN) to develop, fund and implement projects to enhance the civil society’s participation in the electoral process. The contributors of the basket fund include the Department for International Development (DfID), Canadian International Development Agency, United Nations Development Fund for Women (UNIFEM), United Nations Development Program (UNDP) and the European Union (EU). The main objective of the project is to help achieve transparent and credible elections that are domestically and internationally recognized, by strengthening and promoting the technical and operational capacity of INEC in the conduct of elections and maximizing people’s confidence in the outcomes (INEC 2007).

The key projects sponsored by the UN JDBF include deploying IFES staff to support the election administrators; voter education efforts which included partnering with IFES and the National Education Research and Development Council (NERDC) to produce a voter education handbook for use in school curricula; production of voter education docudrama for broadcast in conjunction with the Nigerian Television Authority (NTA); training for INEC staff and the police and other security forces safeguarding the elections.

The federal government, through its ministries and INEC, also promoted the system by sponsoring media campaigns, sponsoring pilot registration schemes in the capital territory and demonstrations of the system for the National Assembly and the populace in general, providing subsidies and import duty breaks for suppliers of the systems, and provision of sundry funds to mediate trouble situations.

In the remainder of this paper, we examine the institutional efforts to promote the adoption and usage of the electronic voters' registration system and ensure a significant voter turnout and participation by all stakeholders. We draw on King et al.'s (1994) framework to analyse these interventions and reflect on the reasons they failed to achieve desired outcomes.

Analysis

Knowledge Building and Deployment

Knowledge building refers to actions taken to generate scientific and technical knowledge required to produce or use innovations, while knowledge deployment involves stimulating the dissemination of new knowledge by means of individuals, organizations or knowledge repositories. In this sense, King et al. (1994) suggest that knowledge building is necessary for the production of innovations, but is not essential for their use i.e. for their adoption and diffusion, whereas knowledge deployment is required for significant production or use of IT innovations.

The most obvious type of knowledge building is research and development, whereas forms of knowledge deployment include the general provision of education to the population and the use of already knowledgeable individuals and organizations in establishing operations in the country (King et al. 1994). The latter approach not only ensures skilled and specialized implementations, but also effects training either directly or indirectly through exposure for the users of the systems. Policy documents produced by the Nigerian government's Federal Ministry of Science and Technology (FMST) recognize the essential role of research and development in sustaining scientific and technological infrastructure (FMST 2007a). However, we found no substantive evidence of a research effort involving INEC staff prior to the introduction of the electronic voters' register. Rather, the system was implemented based on the recommendation of IFES, privileging imported technical/rational knowledge over indigenous sources.

The approach to generating and deploying knowledge was to integrate a panel from IFES and the European Union Election Observation Mission who were called upon to support staff training in the use of technology for electoral processes and establish the protocols of democracy and good governance in the conduct of elections. This panel consisted of an 11 member core team, 66 short term and 60 long term observers from 21 European Union states. Training was carried out by the vendors who supplied and installed the system.

It would be reasonable to expect a certain degree of proficiency from users of the system due to these efforts at knowledge generation and deployment. However problems were encountered with the adhoc staff contracted for the registration exercise:

“You train a set of people [temporary staff] to carry out the work, but on the field you see a different set. The original persons trained would have subcontracted their jobs to relatives and friends who do not have adequate skills for the roles. And there were no measures to ensure compliance from the parties concerned. It was simply impossible to monitor everyone involved with the registration process” (Assistant Director, Voter Registry department).

Another problem related to under-aged registrants:

“there were reported cases of under-aged registrants. The recommendation for suspicious cases was an interview of the individual by the representatives of the political parties who would have to come to a unanimous decision before allowing such individual to register. No amount of training would have equipped the commission’s [INEC] staff to deal with such situations effectively without the use of proper identification” (ICT director).

These two statements reveal deficiencies in the organization and operation of the system in dealing with identity issues, highlighting the limitations of the institutional interventions. In the first case, compliance and monitoring mechanisms were insufficient to prevent subcontracting of temporary work to untrained staff during the registration period. In the second case, a lack of records in the form of birth certificates, international passports or other adequate forms of identification hindered the process of eradicating the electoral malpractice of under-aged registrants.

Further problems arose in some cases due to religious and cultural beliefs:

“some people refused to have their pictures taken. They said it was against their religion... The turnout for registration was low in the beginning. It is the Nigerian factor to leave everything to the last minute. We are only punctual when there are sanctions or rewards. People were demanding compensation for registering. Some even asked for copies of the pictures taken” (Assistant Director, Voter Registry department).

Religion in this context refers to religious beliefs of supernatural control and sanctions. Specifically, certain groups believe that perils could come from unnecessary exposure in the photographic images since this is a means through which divine requests are made, i.e. people attach photographs of themselves, friends or family to a list of requests and hand them over to their religious leaders for divine intervention. Thus an accepted method of identification in many nations proved problematic in this context.

Revisiting King et al's notion that knowledge building is necessary for the production of innovations but is not essential for their use, i.e. their adoption and diffusion, our work suggests that, when systems are imported into a DC context, knowledge building has increased importance for adoption and diffusion. The fact that there was no substantive research effort involving INEC staff reveals the rationalistic assumption that an information system produced abroad can be transferred to a DC context without the need for prior engagement of the indigenous users. However, such engagement might have revealed that certain underlying assumptions on which the system is based (e.g. the presence of adequate monitoring mechanisms, appropriate forms of identification, and particular cultural beliefs) are inappropriate in the Nigerian context.

Subsidy and Mobilization

Institutions may intervene to provide subsidies to innovators or users to offset the costs or risks they sustain during production of an innovation or usage which aids its diffusion. Mobilization, on the other hand, involves intervening by spreading messages designed to persuade actors to think in a certain way about an innovation. On this basis, King et al. (1994) suggest that subsidies may be crucial instruments in the process of innovation, but are not essential to the production and use of an innovation. However, mobilization efforts, while important but not essential stimulants to the production and use of innovations, can have a dramatic effect when used in conjunction with other institutional interventions.

Subsidies may take different forms, but reference here is to activities targeted to achieve a specific outcome. Such interventions within the Nigerian government usually take the form of grants and loans, e.g. the Technology Innovation Fund, a Ministry of Science and Technology initiative, established for SMEs that want to acquire IT innovations for business support, and the Computer for all Nigerians Initiative (CANI), a National Information Technology Development Agency (NITDA) initiative, which subsidizes the cost of computers and allows local computer producers to import required parts without paying the required levies (FMST 2007b). In this case the government is subtly directing preference towards domestic products, thus empowering local industries in addition to aiding diffusion of the innovations.

Mobilization uses more direct means by spreading positive messages to influence stakeholders. The most common methods are advertisements, awareness campaigns, publications, conferences and exhibitions demonstrating the use of the innovations. However, higher education institutions and professional associations also have significant mobilization roles promoting innovations to key players in organizations as essential to organizational welfare (King et al. 1994).

The electronic voters' registration system benefited from both forms of intervention, i.e. subsidies and mobilization. Funding of prototype development and demonstration projects is a form of subsidy (King et al. 1994) and this can be likened to the government's sponsorship of the pilot registration schemes carried out in the federal capital city of the country prior to the nationwide implementation of the system. Subsequently, full funding for the project was provided by the federal government along with the withdrawal of import duties on all system related items. In order to mobilize people to participate in the registration exercise an extensive awareness campaign was mounted informing citizens and other stakeholders about the objectives and merits of the system. This campaign took the form of advertisements, seminars, demonstrations etc. using all available broadcast media dubbed with slogans, for example "know your rights, register to vote". Other interventions, though closely related, cannot be easily identified as subsidies or mobilization. For example, at the start of the registration period, there were not enough data capture machines to be deployed at the proposed locations, due to delays caused by the suppliers.

To avert the situation, the government provided sundry funds to purchase laptops, digital cameras and scanners as a contingency measure prior to delivery of the machines.

While subsidies can alleviate the costs of production and usage of innovations, the source of the funds can give rise to unexpected impacts on stakeholders' perceptions of such innovations. As a prominent member of one of the political parties suggests:

" it is necessary for INEC to become truly independent. The Presidency has too much control over the commission and it can only gain the peoples' confidence in delivering genuine election results if it can be detached from that control. After all, he who pays the piper dictates the tunes"

This statement indicates a flawed power structure surrounding the sponsorship of the electoral process. Since funding for INEC comes directly from the office of the president in power, some stakeholders believe that the head of government can influence the commission. Thus they are reluctant to participate in, or trust the outcome of, any innovation arising from such interventions, hindering the adoption of the system.

Furthermore, the mobilization messages promoting the system may have been effective in increasing voter turnout, but there was evidence of other parochial interests:

"I don't think the campaigns had any effect on my decision to register. I was going to register regardless because I wanted to vote to have a chance to replace the government in power"

"some legislators resisted the introduction of the system because they felt they had no control over the outcome. They didn't see a chance to manoeuvre the system"

Mobilization can also give rise to unintended outcomes if the propagated messages are misunderstood. In this case, the slogans broadcast by INEC and government sources alleging “this is your vote, this is your world”; “computerization will reduce election fraud” were taken by some voters to mean that the innovation would eradicate all forms of electoral fraud and not just registration fraud. Messages that seemed clear to the ICT director and Voter Registry staff were a source of disappointment to eligible voting citizens after the elections amidst reports of high rates of electoral malpractice:

“the selling point for the registration was the end result, which was voting results. We were made to believe that the new system would produce more credible results. Perhaps if that was the case in the end then our perception [of the system] would be different now”

“I thought there would be a difference in the voting pattern. The computerization made me think there would be better accuracy and that results would be immediately available. I didn’t realize it was still going to be manual voting and manual counting”.

Our work suggests some qualification of King et al’s notion that subsidies and mobilization are important but not essential stimulants to the production and use of innovations. Specifically, it highlights the unintended outcomes that can result from such efforts and how they can undermine the innovations they were intended to promote. For example, awareness campaigns were persuasive in mobilizing people to register for the Nigerian elections. However, when the elections were over, citizens’ expectations were dashed as electoral fraud persisted. Questions were raised about the trustworthiness of the institutions promoting and subsidizing the system. In this case, there was increased scepticism, which in the longer term may negatively influence the prospects for the system’s future use.

Standard Setting and Innovation Directive

Standard setting refers to regulation constraining actors’ options in innovation situations in line with broader institutional or societal goals, while innovation directives are commands to produce or use an innovation or engage in activities that will foster its production and/or use. Thus, King et al. (1994) suggest that although standard setting is an important form of institutional intervention in the production and use of an IT innovation, it is risky and can be counterproductive if employed without the agreement of interested parties. Innovation directives, by contrast, can be powerful stimulants to innovation and diffusion in special circumstances, but are less significant in sustaining production and use in the long term.

Standards are agreements amongst stakeholders about the preferred way of doing things which can be voluntary or enforced by law (King et al. 1994). Standards can explicitly favour an innovation, as in cases where ‘best practice’ is advocated, or they can imply such preferences, as when minimum performance levels are set which require the use of a particular innovation. Innovation directives are commands rather than agreements, which may, for example, mandate how an organization spends its budget, what products it adopts or how its operations are structured. An example is the directive from the West African Examination Council in Nigeria which requires students to check their GCE results online.

The electronic voters’ registration project did not reveal much evidence of standard setting beyond the use of electronic means of registration. Although computerization of the entire electoral process is being proposed to the legislative arm of government, it is yet to be agreed upon. However, there were several innovation directives designed to encourage participation. An initial two month period was set aside for the registration of voters. The deadline was extended by an extra month to stimulate further turnout of registrants. Also, some work days were declared public holidays to encourage those who would otherwise have claimed they were too busy to register. Furthermore, some state governors threatened to seize salary from those who did not produce their voters’ registration cards to confirm that they had registered. While there is no legislative basis for the governors to enforce such directives, the threat of sanctions was effective in forcing the states’ public servants to the registration units.

In this context, the use of standard setting and innovation directives seems to necessitate certain prerequisites:

“ there is a gap between setting standards and regulating them in this country, at times it is near impossible to reach certain areas to ascertain the compliance to the standards set within that industry” (IT Adviser to the Federal Ministry of Science and Technology)

“ people were shading all sorts, some even shaded outside the boxes..... but in the new system, power outages kept interrupting the registration [process] and some people who promised to return after did not..... a queue is a queue no matter how short. Nobody likes waiting especially in the sun [heat]” (Staff member, Voter Registry department of INEC).

The above statements show that a country’s infrastructure (including road and rail links, power supplies, etc.) and its citizens’ literacy levels are key aspects affecting the likely success of institutional interventions. In the case of both standards setting and innovation directives, poor infrastructure impacted the long term utility of the interventions, while in the latter case poor

literacy levels required the education of citizens above and beyond the requirements of the particular innovation, diminishing the power of the directives to use it.

Reflecting on King et al's notions about the importance of standard setting and innovation directives, their work is based on an underlying assumption that effective regulatory and monitoring mechanisms are in place to ensure compliance. However, even in cases where compliance is intended, structures to aid this compliance might be in short supply. Thus, as with cases of the transference of knowledge from abroad, the framework is found wanting in an appraisal of the situation on the ground.

CONCLUSION

This paper examines the introduction of information systems in developing countries and discusses the efforts of the prevailing institutions within these countries to promote the adoption and diffusion of ICTs. The concept of ICTs as an instrument for development was established as a powerful rationale for this approach although its justification was not determined. Instead, our aim was to explore the sufficiency of institutional interventions in promoting the adoption and diffusion of ICTs within the DC context. The focus of our research was a case study involving the adoption and use of an electronic voters' registration system in Nigeria. We employed a framework for examining institutional interventions (King et al. 1994) designed to promote such innovations. This framework guided the collection and analysis of our findings, the implications of which are presented in this section.

King et al.'s framework proved useful in analysing the scope of institutional interventions in the DC context and shedding light on issues associated with IS adoption and diffusion within such countries. Nevertheless, our understanding of why these efforts sometimes fail to achieve desired outcomes prompted us to consider other important themes. Our research suggests that there is a limit to what the institutions can achieve against the desired objectives. Although research has illustrated the significant role of institutions in promoting ICTs in the western countries, the nature of the constraints faced by INEC and the Nigerian government leads us to consider other issues and possible strategies when deploying information systems in developing nations. The difficulties being faced in this case can be traced to different (and additional) challenges highlighted by our study.

For example, the concept of institutions has a different meaning in developing countries. The electoral body in Nigeria has been undergoing a constant process of dissolution and re-

establishment and thus INEC has not had enough time to gain the necessary trust required to instil confidence in the citizens, a prerequisite for institutionalization. Thus it is hampered in its efforts to gain general acceptance for ICTs. Governments in most developing countries are in a similar situation – plagued with instability under successive military regimes they have only just begun the process of democratization.

There should also be much consideration for society and its values. Modernization efforts may ignore the prevailing circumstances in the developing countries and this often leads to inaccurate diagnosis of problems. Poor infrastructure is often inherent in such countries (Hempel and Kwong 2001), yet this is an essential element for the successful use of modern technologies, the absence of which may be likened to having hi-tech cars without good roads or cinemas without an electricity supply. Thus development levels are highly exposed in their primitiveness by modernization just as modernization is always hampered by development, creating a fuzzy environment. The decision to adopt certain systems should be reviewed to take account of the available infrastructure, in addition to issues of power and politics, literacy levels, culture and religion.

Our case study highlights institutional interventions that demonstrate (i) a lack of consideration for infrastructure issues, evidenced by the effect that power seizures had on the registration exercise; (ii) a lack of consideration for literacy levels, evidenced by the 80% error rate reported in the first electronic registration system; (iii) a lack of consideration for power structures and politics, evidenced by citizens' perceptions about INEC, the government in power and the relationship between them; and (iv) a lack of consideration for religion and culture, evidenced by the refusal of some people to participate in the registration exercise.

In suggesting the potential for further research, we acknowledge the limitations of our study. This research was conducted over a three week period by the first author, who is a Nigerian national. More insight might have been gained from a longer study which sought a more diverse range of stakeholder opinions. Furthermore, participants in the study might be more inclined to discuss issues relating to the elections once the election tribunals have resolved disputes. Future research might explore experience with alternative technologies used in the Nigerian context, with alternative systems used in the electoral process (in both voting and registration), and take account of lessons learned from other developing countries. For example, studies could focus on the use of internet or mobile communications technology, which seem to be at a more advanced level of adoption and diffusion. They might also examine experience with e-voting systems in

another developing country, for example, Avgerou's (2007) work in Brazil. Or, they may focus on comparative analyses of experience in different countries, which may help to explain why some developing countries have been so successful in innovation while others have not.

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Competencies and learning for management information systems – the case of a health information system in Malaŵi

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Abstract

Previous research has established that users need competence in both computing and the context of the software. Information systems often fail due to low competence amongst users, and no study is known to provide a systematic account of the user competence needed. This research concerns competence needs amongst users of a management information system where there is no operational IS from which to obtain data for the MIS. The study shows that three subject matter areas of user competence are needed for IS, domain knowledge, work competence and computer literacy, and numeracy is a fourth area needed for MIS. Nonaka's (1994) model of organisational learning distinguishes between tacit competence learnt through internalisation and socialisation and explicit knowledge developed through externalisation and combination. Work competence, being management in this case, is basically tacit competence, while domain knowledge, computer literacy and numeracy are based on explicit concepts. User training should therefore start with practice in the case of work competence and presentation of concepts in the three other subject matter areas.

Keywords: Organisational learning, user competence, user training, support, computer literacy, MIS, implementation

Introduction

Orlikowski (1992) demonstrated the need for learning how a groupware system fit into work. Sein, Bostrom and Olfman (1998) proposed a six step model for user competence, where the three lower steps concerned learning to use the functionality of the software. Step four was to understand the general purpose of the system in the organisation, step five, inferential, to develop more abstract concepts in order to see what the system could do in addition to what training said, and step six, motivational, to develop the imagination to see what the system could do to me and the organisation. Competence on computer systems as well as on their use seems necessary.

Marcolin et. al. (2000) used the categorisation of cognitive, skills, and affective competence for studying methods of measuring user competence. Skills relate to the lower levels of Sein et.al.'s model, while cognitive competence concerns the higher ones. The affective competence, which Marcolin et.al. studied, was self-efficacy. Their categorisation of competence is taken from pedagogical research in schools, which often classify learning goals in these three types.

In a model of development of competence in organisations, the main distinction is drawn between tacit and explicit knowledge (Nonaka, 1994). Explicit knowledge is what is found in textbooks and literature, while tacit knowledge is the competence that enables the practice in the organisation. Nonaka also distinguishes between individual and social competence. These dimensions of competence differ from the categorisations for schools, although skills and affective competence is often in the individual, tacit area, while the cognitive is individual and

explicit. Since this research is on competence development in organisations, the Nonaka model will be preferred. This paper aims at characterising the competence dimensions of management information systems according to Nonaka's model.

There is a multitude of types of information systems, like operational, knowledge, e-business, e-government, and they all have distinctive competence needs. This study has examined a management information system with its specificities. The research advantage of a MIS is that it concerns people and groups at both operational and managerial levels, and its purpose of improving organisational performance is more challenging than handling transactions. Marcolin et. al. (2000) also distinguish between subject matter areas, and correspondingly, management information systems involve several areas, including computing and the domain to be managed. This study will characterise the subject matter areas in terms of Nonaka's model.

While being aware of the competence needed, new insight into learning to become better users is the main goal of this paper. Nonaka's model characterises learning as a continuous loop between the four competence types that appears in his 2x2 dimensions. Based on empirical studies and literature, the paper will identify starting points for learning in the different subject matter areas. In order to unveil competencies, one could research an organisation where the MIS runs smoothly, its data is used in management, and which contributes to organisational change. Such a study could provide many insights, but a possible obstacle for research in such a setting is that most competencies are tacit and thus difficult to spot, and the organisation could rely mainly on socialising for retaining and improving its competence. The case chosen here is of an opposite kind, where competence and other resources are scarce, thus finding ways of organisational learning is crucial. Also, the system is only partly computerised, so that information work can be studied both with and without the digital equipment, thus the computer literacy part can more easily be separated from other MIS competence.

The research was carried out in Malaŵi as a part of a multi-country project on health management information systems (HMIS) in Africa and Asia (Braa et al., 2004). The HMIS produces health indicators, visualised in graphs. The chief software developer made a rough estimate that 80% of resources in the project are spent on training and support

The health service workforce of Malaŵi consists of 15,000 people. According to developing country standards, there should have been twice this number; 64% of the nursing positions are vacant, and only a minority of the employed staff has the required professional training. A

massive hiring is a futile strategy for improving this situation due to the lack of qualified applicants. The health education is of international quality, but computer literacy is scarce. Practical implications are provided in the section on supporting the learning of the HMIS.

Competence development

Organisational learning

Three reasons why relevant learning theories should not be restricted to the individual level are:

- The need to regard user competence development in groups, as shown by Gallivan et.al. (2005)
- the aim of retaining and developing competence in the organisation, and
- the purpose of the MIS, which is to improve organisational performance

Nevertheless, the individual will be taken as a starting point for characterising learning.

Following (Lai, 1997), *individual learning* is development of competence which provides a relatively stable change of the potential for action. The requirement of relative stability is necessary to differentiate changes in patterns of behaviour from random changes. If action does not take place, the reason may be that there is no room for action, although the competence is present. Change of behaviour therefore also presupposes the necessary room for action.

While individual learning aims at changing individual action, *organisational learning* concerns development of relatively stable change of the potential for cooperation (Skorve, 2007). And again, unless conditions are present, the organisational competence will not lead to changes in the organisational behaviour. For example, the staff might have learnt that regular meetings with neighbouring clinics are useful, but unavailability of transport renders these meetings impossible. From the concept of cooperation follows that *two* is the smallest number of people who have to be involved for organisational learning to take place. Cooperation is to be understood in a broad sense, including the relation between a manager and a subordinate, regardless of the democratic or dictatorial attitude of the manager. Organisational performance is dependent on both individual and cooperative work, so change of this performance may require both individual and organisational learning.

Nonaka (1994) has extended the individual-collective dimension with the explicit-tacit one for characterising the learning processes in organisations. Explicit knowledge is the theoretical type of knowledge found in textbooks and other representations, which are detached from the activity where the knowledge is used, and which is often called know-that. By contrast, tacit knowledge denotes the know-how, skills, and automated procedures, which are used in familiar situations.

Lam (2000) has developed this model further; through characterising four types of knowledge, as shown in 4.

Embrained (individual, explicit). An individual's formal, abstract or theoretical knowledge

Encoded (collective, explicit). Knowledge with external representation, including data in computers

Embedded (collective, tacit). Shared beliefs and understanding in an organisation

Embodied (individual, tacit). Practical skills and individual beliefs

See Appendix 4

Nonaka (1994) also identified four processes of transformation of knowledge. Starting from the embedded knowledge, individuals are *socialized* into a community. The social process of combining different chunks of individual knowledge is called *combination*. The transformation of the explicit to the tacit is called *internalisation*, while the opposite process is *externalisation*, and these could take place in both the individual and the collective case.

Instead of using the word *knowledge*, the concept *competence* will be used in the following to signal that the abilities of those competent are related to specific tasks.

Since a MIS is a system for the collective, explicit codes, the encoding type of competence is crucial for its functioning, and it is the kind of encoding that is useful for management that is favoured. Other studies of HMIS in the region conclude that local contextualisation of training is necessary for developing the competence needed (Williamson, 2001, Mukama, 2003), thus supporting the need for the embedded type of competence.

Subject matter areas

Marcolin et. al. (2000) bring in "knowledge domain areas" as a dimension in their classification of user competence, and work processors and spread sheets constitute the areas of their study. These areas only concern the type of software used, while Orlikowski (1992) and Sein et.al. (1998) emphasized the need for competence both in computing and its context. In the field of IS development, the context is divided into the domain of the information system and the work tasks in which the IT is used. The domain is described in a class model, which is implemented as a data structure, while the tasks are mapped into use cases, providing the functionality of the software. In general, the subject matter areas requiring user competence therefore consists of the software, the domain and the work tasks.

In a study of another HMIS, Sahay and Molla (2007) identified three competence areas, technical, public health, and implementation and use context. Being a HMIS system, the use context is management. Like any other MIS, understanding the data also requires numerical skills. The subject matter areas of competence needed for using HMIS are thus management, health, numeracy, and computing.

Computer literacy is a scarce competence in many developing countries. Being a machine based on simple principles, one should expect that its teaching would favour the embrained, context-free, scientific style of competence. However, reports show that mimicking instructors' behaviour displayed by a projector is a favoured style of teaching (Herskin, 2006), thus students get socialised without necessarily understanding the principles behind the operation of the software. Also, such courses tend to favour teaching of computer use that is not related to the learners' work, meaning that they get socialised into the wrong collective. A study of learning of basic principles shows that principles are not learnt unless the teacher explains them explicitly and devotes enough time for practicing (Stamatova and Kaasbøll, 2007).

A comprehensive study of computer training in an HMIS was carried out in Zanzibar, including general computer literacy and use of the same software as in Malaŵi (Ngoma and Kaasbøll, 2008). By using health data and running interactive sessions on data entry and reporting, the middle line managers and staff became socialised into running the system and also contributing to improving data quality. A check on system performance three months after training demonstrated that organisational learning had taken place and had yielded improved performance.

Arithmetic and graphs are school material of the scientific type, and most maths education presents concepts and helps to internalise through repetitive exercises partly within domains with which the students are already familiar. The failure of many people to master calculation of percentages is nevertheless common in all parts of the world, and numeracy requires also the ability to express reality in the formal language of maths.

The health domain is based in medical science, so again, the school training would be favourable. No generally accepted categorisation of work tasks seem to exist. Markauskaite (2007) suggests a general set of areas of ICT literacy: plan, access, manage, integrate, evaluate, create, communicate, collaborate, reflect and judge, and a survey amongst teacher students showed that these were clustered into five groups: problem solution, communication and metacognition (reflect and judge), basic ICT capabilities, analysis and production, and information and internet-related. Phelps et.al. (Phelps et al., 2005) distinguish between IT capability and competence,

where competence is limited to the technical skills, while capability requires metacognitive skills in addition, like ability to learn, adaptability to change, willingness to experiment, etc., thus less restricted than Markauskaite's definition.

The current study is limited to health management tasks. While computing and the domain of the information system are based on science and technology, the work tasks for which an IS is used would normally constitute a practice for which there is no school subject to study. MBA studies teach managerial tools and techniques, but this approach to management training has been severely criticised. According to Mintzberg (2004), management competence, and leadership competence in particular, can only be developed based on experience, and due to managers' role, their experience will be part of the collective area in Lam's model, that is the embedded competence.

Case – organisation and work

The Malaŵi health system serves a population of 12 million, and life expectancy is 37.5 years and declining. The health service is carried out at clinics, to which the patients come. The clinic staff reports quarterly the number of children fully immunised, the new number of HIV positives, the number of nursing hours and more than 100 other data items on paper forms to district level, where the data is entered in a computer, although the clinic managers could also be considered as working in the middle line. The district is staffed with a health manager; immunization, HIV, and several other vertical programme coordinators, and a specially appointed HMIS coordinator has HMIS as her or his main task in each district. The districts report to the Ministry of Health, where the national HMIS manager works.

Also almost all the appointed managers have patient care duties, and likewise, all health staff carry out management as part of their job, at least of their own tasks. The HMIS is a system for supporting the management function, so it concerns all staff to a larger or smaller extent.

The software computes health indicators and presents them as graphs showing changes over time. Indicators are presented and discussed in meetings where district managers convene with clinic representatives, and similar meetings take place between the districts and upper level management.

Ethics and data collection

Since the study did not cover individual patient information or medical procedures, the only ethical consideration is that data collection consumes the health workers' time, which could in

many cases have been devoted to patients. This is compensated by a 10% levy on the research expenses paid to the Malawian Ministry of Health, which granted the permission for data collection.

Aiming at uncovering types of competencies and ways of changing them, a qualitative approach was selected. Within two health districts, 53 interviews were carried out and 13 meetings were observed during August – October, 2006. The two districts were designated by the Ministry of Health due to their difference in HMIS performance, one good, one bad. The informants were selected by the researchers and covered staff at all levels, with emphasis on staff in various kinds of managerial roles. In addition, two hours of observation was carried out at a master course in public health in March, 2006.

Interviews normally took place in the informants' workplace and took 20 minutes to 2 hours. The interviews conducted were mainly in English but some of the respondents preferred to use the local language Chichewa, which one of the research team members spoke, and she translated when necessary.

Notes were taken, but no voice recording took place due to the informants' unfamiliarity with electronic recording.

HMIS competence in the organisation

This section will present empirical findings according to the four subject areas and characterise the competencies and learning which can explain them.

Management

The HMIS aims at improving the service by providing managers with a tool to assess performance for subsequent action. One of the programme coordinators gave an example of this: For example when I get the reports, I check how many EmOCs and deaths they had, how many patients were referred from this facility and if they have many cases it shows that they are not able to perform certain functions/service properly so it means they have problems and maybe need training.

The decision taken by the coordinator was based on her embrained public health competence and embodied competence of correspondence between referrals and deaths. She opens for a trainer to share embrained and encoded competence with the health staff, which might manifest itself in organisational learning.

The programme coordinators are responsible for ensuring that the services are organised in a way that meets the patients' needs. One coordinator gave an example of how data was used to modify service delivery in the Family Planning programme:

The reports show how the programme is performing, for example it was noted that there are low figures in Norplant clients and that most women were going to BLM [a private clinic] and we discovered that it was because when women came to get that service at the hospital, they were always told to come another day because no one was available to provide that service. So we decided to commit one day of the week for which someone is made available to provide this service at the hospital.

Based on the information received, a new form of cooperation was established, so organisational learning took place. Being anchored in the organisational behaviour, this competence seems to have developed into the embedded form.

The reports guide the coordinators in identifying problematic areas and these are further investigated during supervision. One coordinator explained that

By looking at the reports, I can see which facilities are having problems in terms of submitting on time and filling the reports (i.e. have gaps) and so I take note of these facilities and when I go for supervision I investigate the reason for this.

The embodied knowledge of being able to spot problems may lead to a discussion with the health staff, opening for organisational learning.

In one instance, one coordinator felt that there was nothing he could do to act upon the information as he stated:

'I see the graphs showing how we have performed but there is nothing I can do to change the situation because it is the ministry who decides what [amount of drugs] we get'

In this case, the manager could have taken a decisional role or a spokesperson, but he ends up doing nothing. Learning took place, but its potential for action did not materialise due to lack of room for action.

An example from a quarterly meeting between clinic managers and some other clinic staff is presented below. One of the clinics presents a nicely, hand drawn graph on immunization, and a discussion between him and the manager of another clinic emerges:

- We only reached 77.6%, which is below the target and worse than the last quarter.
- Why is it so?

- When we had scheduled measles immunisation, only 13 children turned up, and we are not allowed to open the bottles when less than 20 come.
- You can't send the children home; that is not fair. We allow for fewer children.
- That's not according to the guidelines.

No conclusion is reached, but the dilemma seems obvious to all present, and arguments for both sides were raised. The manager who followed the guidelines perceived that there was no room for action, much similar to the previous case. The other manager, however, did not accept the structure of the encoded guidelines, so this clinic had developed embedded competence through organisational learning, and in addition, they had developed the embedded competence that the guidelines can be broken, thus learning that their room for manoeuvring can be extended. The explicit discussion that took place might lead to similar or opposite organisational learning in some of the other clinics present in the meeting.

As indicated above, clinic staff manages their own work, they report HMIS data to the middle line, but this data is not used in the clinics. Some staff expressed a need to learn how they could use collected data in order to understand why data was collected. A health staff member responded that the lack of interest was:

... because we do not understand how we can use it!

The health staff seems to possess an embrained competence of the HMIS data and its encoding, but a striking lack of embeddedness of this explicit competence into their own management.

The examples indicate that management competence to a large extent is of the tacit type, and that it has to be embedded in order to be effective.

Numeracy

During a meeting, the graph in XFigure 2X was presented by a clinic manager. Competence needed for creating this includes calculation of percentages, how time can be represented in graphs, how to determine scales, colour coding, interpretation of percentages larger than and smaller than 100 etc. Arithmetic and visualisation of numbers are competence of the embrained type, which in this case has lead to a successful encoding. There were other examples of more senseless graphs generated by means of a spreadsheet, where for example the percentages of fully immunised, BCG, penta, polio and measles were occupying one sector each in a pie chart.

When numerators changed place with denominators or dysfunctional graphs were produced, the HMIS officer or others had to turn to their embrained numerical competence and make the

mathematical principles become explicit for the health staff or managers. Learning mathematics only through imitating others and never been explained the principles, would probably imply that most of us would never understand the principles since we are not professional mathematical researchers.



Figure 2. Immunization indicators for three months.

The domain and its encoding

The MIS studied has public health as its domain, so users need to know how vaccines should be stored, how HIV can be prevented, the health benefits of closed latrines, etc. Without this scientific knowledge and its embedding in the local community, the health services including the HMIS would be futile. There are time bound regularities in the health of a population group. Tuberculosis incidents are relatively uniformly distributed, malaria has seasonal variations, and cholera have sudden outbreaks. This is again embrained competence based on science, which a programme manager used:

“[Facility Name] is the worst performing facility and I know this because when the reports come from this facility, the figures fluctuate a lot so it seems they are just guessing the figures, and they usually report late.”

Saying that they report late, the manager indicates that the trouble lies in the reporting, and not in the domain competence of the clinic. Another example also points to the individual competence of managers:

By looking at the coverage rates and dropout rates on the reports, we can compare with the WHO standards and this tells our performance.

The scientific basis of this comparison of encoded performance has been learnt as embedded competence during education. The next two quotations illustrate what a manager does when trying to correct erroneous reports:

At one time, a certain facility reported on the HMIS form that it had zero cases of Malaria and I knew that it could not be true so when I asked the facility they gave me a figure.

By looking at the reports, I can see which facilities are having problems in terms of submitting on time and filling the reports (i.e. have gaps) and so I take note of these facilities and when I go for supervision I investigate the reason for this.

In addition to the embedded competence needed for diagnosing the errors, these managers have also used their embedded social competence for finding reasons for mistakes and achieving a corrected encoding.

Tools for handling the representations – computer literacy

Clinic staff reported on paper forms, they drew graphs manually as illustrated above, and they infrequently received copies of the computer reports prepared at the district level. The HMIS officer, also called the statistician, was one of the few people in the district being competent to run the HMIS software. One of the programme coordinators said:

The graphs are used during national level meetings where the data for all districts is reviewed... I ask the statistician to produce graphs for me for the meeting... I give him my programme data to use for making the graphs.

The statistician was regarded competent to do the reporting by means of the software, which requires computer literacy in addition to the domain knowledge and numeracy.

The HMIS officer also knew what the programme reports should look like, so he seems to have the collective competence of knowing who needs what. Even though some of this may be found in encoded guidelines, local adaptations call for development of embedded competence in this area in the middle line.

Discussion and conclusion

Organisational competence

Learning was defined above through its results, but the definition did not say anything about the process of competence development. Nonaka (1994) postulates learning processes of internalising, socialising, externalising and combination.

The learning processes concerning the MIS seem to start from two different bases. Learning the arithmetic comprises starting out with concepts and principles of the explicit kinds and internalising and socialising these through working with the real data from the clinics. Without the socialising, no organisational learning of arithmetic will take place. Similar learning processes should happen concerning the domain, its encoding, tools and computing, but as stated above, learning processes of computing tend to have weaknesses in the initial step of embracing the principles.

Learning management starts from practice. Based on embedded competence, general, explicit concepts can be embraced and again internalised, leading to possible individual and also organisational learning. Cooperation patterns may change even if the explicit concepts that were internalised by one manager do not become collective, as long as the internalised change becomes embedded in the organisation.

Learning subject matter grounded in science usually start out by training, while learning subject areas which are mainly of the embodied or embedded type could start from practice.

User competence

Both Orlikowski (1992) and Sein et.al. (1998) emphasized that users need to understand both computer systems and its work context, while Marcolin et.al. (2000) only regard the software competence. The HMIS study confirms that context is of two kinds, domain and tasks. Work tasks, here managerial, are normally based in practice, while the domain of health is based on science, and it requires numeracy as a third subject matter. In the case of spread sheets, both numeracy and the domain of the numbers should be included, and concerning text processing, language skills and also domain competence are needed for using the IT tool for improving organisational performance. Work tasks constitute the additional practice based competence. Tasks and domains constitute levels four to six in Sein et.al.'s model (1998), and the HMIS case shows that use of the IT tool requires competence in all relevant subject matter areas, including the software area.

Practical implications

Any activity can trigger learning, but in order to accelerate the process, three supporting activities had been established; formal education, supervision and a recognition scheme for data quality.

The formal education consists of master courses in public health. Here, the participants brought their experience for presentation, discussion amongst colleagues and theoretical input from teachers, in accordance with how Mintzberg (2004) envisions management training. A participant

told about how a cholera outbreak was discovered and reported, how the houses of those infected were located, and by means of the local competence of the villagers, a well where the lid had been damaged and animals had been, was finally located. Lively discussions took place, and the teachers emphasized the strategy of searching from the houses and upwards in the terrain. Such an endeavour requires a mixture of competence in public health, reporting, data analysis and management of critical incidents, and while the participants knew the basic principles of cholera and its reporting requirements, the lesson focussed on how to deal with all the factors when trying to stop the epidemic.

District managers, programme coordinators, HMIS officers and specifically appointed staff had supervision as a main part of their duty. Most respondents in this study perceived supervision to be helpful. It was argued strongly that supervision should follow up training and that training was needed first. Supervision or briefing on the job was not perceived to be enough to perform well on HMIS responsibilities. Both increased supervision frequency and access to training was reported by respondents to be potential incentives for improved data quality. Data quality concerns the domain, its encoding, tools and numeracy, which constitute those subject matter areas which, as argued above, lend themselves best to a deductive learning process. The health staff seems to be of the same experience, first learning the theory in a course, then internalising and socialising by means of a trainer at the workplace. The positive appreciation of supervision was not unanimous, however:

When they come they usually just come to check how we are doing or teach us something new. The supervisors who came to check up did not aim at supporting learning, but at monitoring subordinates. Those who came to teach something new should rather have left that to a training course and followed up during supervision visits.

The recognition scheme is an award for the clinic which performs best on data quality during the last six months. Timeliness, completeness and consistency are measured, and the overall best performing clinic receives equipment like flip charts, calculators or felt pens. Awarding the clinic aims at promoting organisational learning and not only individual improvement. The scheme does not include instruction or supervision for learning to improve data quality, so the clinics are left to themselves on how to improve. Most clinics took the competition seriously, so they seemed to have been triggered to manage organisational learning and improved cooperation on their own. Managerial skills needed to submit timely reports and knowledge of definitions of data elements are examples of the types of competence needed for improving data quality. If the clinics are

aware of their ignorance of data definitions, they can ask supervisors for explanations, but if not, the scheme has no mechanism for feedback except for a score. Clinics might therefore repeat erroneous practice unknowingly.

The research team invented a fourth supporting activity for boosting organisational learning of data and software and carried out a pilot experiment. Reporting in the clinics tended to be carried out by one person who had received training for this. If she left the clinic, the reporting competence was lost, and another person had to attend training before reports of reasonable quality could be made. In order to achieve organisational learning, the idea of pair programming (McDowell et al., 2006) was drawn upon. Pair programming implies that two people sit in at one workstation, one uses the keyboard to type code, while the other asks questions, looks up in the programming libraries, checks against requirements etc., so that they keep talking while coding. After an hour, they shift roles. This style of working has improved learning and code quality, and one important mechanism is probably the verbalising taking place, which implies explicating principles and concepts as well as subtle tricks and elegance in the solutions. The social pressure that emerges contributes to hindering dropouts during programming education. This procedure was tested during reporting of quarterly data in a clinic. One of the two had experience with reporting while the other was a novice. After a while the novice questioned decisions made by the experienced, assuring that she understood everything that he did. They also discussed difficult issues and what to fill in complicated fields. After a short while being the one who held the pen, also the novice comprehended the report, they started working together and decisions were based on mutual agreements. Organisational learning took place, but they consumed more time than the experienced person used to when working alone.

Obstacles to learning

The low wages in the health system makes any kind of fringe benefit attractive, and allowances for transport and training were amongst those. Several facility managers reported to find it difficult to orient new staff on HMIS on their own. Some health staff simply refused being oriented because they had not received training and the accompanying allowances. One HMIS focal person explained:

They don't want to learn how to fill the registers or reports because I was the one who went for training. I received allowances, and because I did not share with them they say I should do it.

Raising the wages for educated personnel seems to be the long term means for avoiding this unfortunate implication of the current remuneration scheme.

Learning can take place also without the corresponding organisational change, due to structural restrictions. Such learning of potential behaviour has drawbacks, however. Without practicing, the individual will forget instead of internalise, and socialisation is impossible. Training should therefore either be restricted to those changes that can take place within the structures, or the staff also has to learn to challenge and change the structures when necessary.

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Surviving in the 'dual system': How M-PESA is fostering urban-to-rural remittances in a Kenyan Slum

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Abstract

The 'dual system' thesis has been used to describe the continuing commitment of urban migrants to the village in various African countries. According to literature, urban workers maintain strong ties with the rural area, even after spending a substantial amount of time in the city. One way in which these ties are maintained is through urban-to-rural remittances. In March of 2007, an m-banking application called M-PESA was introduced into the Kenyan market. This application allows for person-to-person (P2P) transfers of e-money via mobile phone, and facilitates urban-to-rural remittances. This study will use ethnographic data collected in a Kenyan slum to show that M-PESA is becoming a tool for the maintenance of urban-rural relations. It will further assert that because it is helping migrants to maintain such relations, it is facilitating survival in the 'dual system'.

1. INTRODUCTION

The 'dual system' thesis has been used to describe the continuing commitment of urban migrants to the village in various African countries (Gugler, 1971; 1975; 1991; 2002). According to these studies, urban workers continue to maintain strong ties with the rural area, even after spending a substantial amount of time in the city. Some even argue that these ties increase in strength as the migrant becomes more established in the urban area (Ross & Weisner, 1977). In a study conducted in Nairobi, Ross and Weisner (1977) found that these urban-rural relations are vital for the survival of the migrants. They not only ease the transition to urban life, but also provide migrants with a source of security during periods of economic and political instability. There are various ways in which the migrant maintains such relations with the rural area. This includes regular visits from the city to the village. It also includes the transfer of remittances, in both cash and kind.

For the rural household, these remittances provide a vital source of income (Evans & Ngau, 1991; Stark 1980; 1991; Agesa & Kim, 2001). Because of the substantial wage differential between urban and rural employment, and the lack of attention given to the development of the rural economy, it is estimated that 30% of households in Kenya depend on remittances for their survival (Kabbucho et al., 2003). Empirical work cites various usages for remittances by rural households. This includes the satisfaction of daily consumption needs, payment of school fees, purchase of farming equipment, and as insurance in emergencies (Chimhowu et al., 2005; Poirine, 1997; Rempel & Lobdell, 1978; Sander & Maimbo, 2005). It has been argued that remittances not only improve household welfare but can also have indirect growth effects on the economy

(Maimbo & Ratha, 2005; Sander & Maimbo, 2005). They stimulate local demand and provide other members in the community with a source of credit.

Various channels are available in Kenya for the transfer of remittances between urban and rural areas. This includes commercial banks, post offices, forex bureaus, bus companies, and friends and family. Even with these numerous channels market research argues that there are ‘service gaps, inefficiencies and unmet demand’ in the remittance market, especially among the low-income segment of the population (Kabbucho et al., 2003). To address this unmet demand, Safaricom—Kenya’s largest mobile service provider—has introduced an m-banking application called M-PESA (Vaughan, 2007). Launched in March of 2007, this application allows for the real-time transfers of e-money via the mobile phone and is being rapidly adopted for urban-to-rural remittances. The application works as follows—those who want to send money must first register for the service by visiting an M-PESA agent and providing them with photo identification such as a driver’s license. After the identity of the customer is verified the agent establishes an electronic account, and links it to the mobile phone number of the customer. To activate the account, the customer deposits cash with the agent. This cash is thereafter reflected as e-money in the M-PESA account. After an e-money balance is established, a wide variety of transactions can be conducted via the mobile phone. This includes checking account balances, making deposits and withdrawals, transferring money and phone credit to other users. The transferring money option is interesting in this context because it facilitates remittances between urban and rural areas. Anyone with a mobile phone number in Kenya can receive e-money via M-PESA, and withdraw it from an agent. Safaricom (2008) has reported that the M-PESA application is being adopted rapidly in Kenya. Between March of 2007 and May of 2008, over 2 million customers registered with the service.² More than 2000 retail locations signed up as agents. The company also reports high rates of person-to-person (P2P) transfers. During that same period, over 9 Billion Ksh (app. £73 million) were transferred via M-PESA.

In this analysis, the adoption and usage of the M-PESA application will be investigated in Kibera—a slum that is located on the outskirts of Nairobi. This site was chosen because it is heavily populated by migrants from various parts of rural Kenya. Data from a four-month ethnography will be used to address the following questions: *Is the M-PESA application being used for the transfer of remittances between urban and rural areas? If so then why is M-PESA*

² In 2007, the population of Kenya was reported to be over 36 million (Yin & Kent, 2008). Although the numbers of registered users was given, the data on usage was not. As such, it is unknown how often the application is being used. Furthermore, it can be assumed that some users registered with the service but do not use the application.

being used over other money transfer services? The main goal of this analysis is to examine whether the M-PESA application is helping migrant workers to maintain their relations in the rural via remittances, and whether it is facilitating survival in the 'dual system'. The study will proceed as follows: it will begin by delineating the urban-to-rural remittance patterns in Kenya, and examining remittance channels in more detail; it will thereafter set the context for the empirical study by providing a brief overview of Kibera; the results of the ethnographic work will follow and the aforementioned research questions will be addressed. The study will conclude by providing suggestions for future research.

2. SURVIVING IN THE IN DUAL SYSTEM: WHY URBAN MIGRANTS MAINTAIN TIES WITH THE RURAL

This article began with an examination of the 'dual system' thesis, which describes the ongoing commitment of urban migrants to their village. The studies applying this thesis argue that social and economic life cannot be analyzed as two discrete systems but rather as one common social field. This is because migrants seek to maximize relations in both areas. As commented by Ross and Weisner (1977) 'residing in a city does not mean shunning rural ties and obligations. Living in the country does not mean failing to look to city relatives for assistance and comfort'. The term 'dual system' was first used by Gugler (1971), whilst examining the involvement of urban migrants to village life in south-eastern Nigeria. He found that most urban dwellers identify with their rural home, feel like they belong there, and are constantly re-affirming their allegiance to the rural. He argued that for low-income earners this tie provides economic security. During periods of unemployment, illness or disablement, the urban migrant can look to the village for support. He further argued that this tie provided the migrant with a source of emotional security. Great comfort is derived from having firm roots and a place of origin. More recent empirical work argues that this urban-rural link continues to be strong (Oucho, 2007; Odhiambo & Manda, 2003; Owuor, 2004). For example, a study conducted by Owuor (2004) in Nakuru town shows that the deterioration of living conditions in both rural and urban areas have forced urban migrants to 'fall back' on rural areas for support. In this section, the various reasons for the maintenance of urban-rural relations will be discussed. Before this discussion ensues, however, the rural-urban migration patterns in Kenya will be examined. Such an analysis will provide an understanding of why migrants leave the village to live in the city. It will also provide insight into why they return. During colonialism, there was an influx of migrants from the rural area into larger cities such as Nairobi. The majority of these migrants did not settle in the city but stayed only for as long as they could find work. This is because the colonial government implemented policies which discouraged the permanent establishment of Kenyans in urban areas (Elkins, 2005). Labour was

recruited on temporary contracts, and wages were kept low. Bachelor accommodation was provided for the workers, which meant that there was very little room for the family of the migrant. Because of the unpredictability of the labour market, the migrant workers would oscillate between the urban and rural area throughout their working life.

Such migration patterns, usually known as 'circular migration', are still common today (Owuor, 2004; Oucho, 2007). There are few opportunities for formal employment outside of the cities, as the government has emphasized the development of the urban economy over the rural (Agesa & Kim, 2001). Wages also tend to be significantly higher in the urban areas, due to union representation and collective bargaining agreements. For these reasons, many rural dwellers continue to migrate to the cities in search of work. This move is not, however, permanent. Most migrants return to the rural when they cannot find work or are ready to retire (Oucho, 1996, Owuor, 2004). According to Oucho (1996) 90.2% of migrants expect to return to their district of origin for retirement, while 76.5% expect to retire in their location (village) of origin. Because migrants plan to return to the rural it has been argued that many are not committed to permanent urban life (Ross & Weisner, 1977). For example, they purchase land in the village rather than the city. They also make frequent visits to the rural area. In his study in Western Kenya, Hoddinott (1994) found that 84.9% of those respondents who had been away for more than one year had visited their family at least once in the previous twelve months.

Several other reasons have been noted for these strong urban-rural linkages. The most commonly cited is related to the ownership of assets, such as land or cattle (Neitzert, 1994; Shipton, 1988). In many parts of Kenya, such resources are usually inherited and controlled by men. The rural home usually resides on ancestral land which is passed down from father to son. Women often do not qualify for the inheritance of land because they are expected to marry and make their home with the husband's family. This means that many male urban workers have, or will inherit, assets in the rural area. Maintaining contact with the rural is one way to help ensure their future claim to such assets (Ross & Weisner, 1997).

Familial structures can also help to explain such linkages. It is common for the wives and children to remain in the village as the men work in the city. Agesa (2004) has estimated that close to one-third of households in Kenya choose this type of living arrangement. Some argue that traditional gender roles can also explain this separation. Kenyan males are often associated with the marketplace and more likely to engage in labour-market activities (Agesa & Kim, 2004). Women, on the other hand, are associated with the domestic and usually responsible for activities

relating to subsistence production on the farm, livestock care, family and household maintenance (Agesa, 2004). Such a division of labour also facilitates the migration of males into urban areas as the wife is available to reside and work on the farm.

The commitment of urbanites to their rural areas can also be tied to issues of identification and belonging (Geschiere & Gugler, 1998; Stark & Lucas, 1988). Geschiere & Gugler (1998) argue that the process of democratization and the reintroduction of multi-party politics brought a new emphasis on 'autochthony' and 'belonging'. This has evoked an obsession with roots and origins and made the village a vital source of power at the national level. The authors further assert that national regimes do very little to discourage such ethnic polarization because it is a crucial base of power.

The ideas on what is considered 'home' can also explain the ties of the urban dwellers to the village. For example, the Luo concept of home (*dala*) incorporates several elements (Cohen & Atieno Odhiambo, 1989). This includes the territory (*piny*), culture (*tibewa*), reproductive soil (*lowo*), the Luo people (*jowa*), and agnatic kinship (*yawa*). For a physical space to be considered the *dala*, it must include all of these elements. It must also under-go a ritual involving the elders and other members of the community. Thus, a Luo migrant can spend their entire life in the city and still not consider it their home.

Finally, the urban-rural linkages can also be explained by the social networks of 'home people' in the city (Gugler, 2002). The migrants place in the urban is often contingent upon the connections that they have in the rural. When migrants first arrive in the city, they often stay and find employment through relatives or friends, which means that city life is heavily influenced by social networks of the village. In a study conducted in Nairobi, Ross (1975) found that ethnicity is the strongest predictor of friendship patterns as only 6% of survey respondents claimed that their closest friend is from a different ethnic group. Furthermore Ross & Weisner (1977) argue that church attendance is based on affiliations with the rural. Many urbanites will choose a congregation where there is a large community of their home people rather than attending a church in their neighbourhood. Because of these strong connections in the urban, migrants maintain an ongoing commitment to village life. They are also provided with a constant reminder of their obligation to those who remain in the rural.

This section has noted the various reasons for urban migrants to maintain relations with those in the rural. As was mentioned above, the transfers of remittances between the urban and the rural is

one of the ways in which these relations can be maintained. In the next section, the urban-to-rural remittance patterns will be revealed. The channels used for the transfer of these remittances will also be discussed.

3. THE NATURE OF REMITTANCES IN KENYA

Empirical studies monitoring urban-to-rural remittance flows all note a similar phenomenon—frequent transfers of cash and kind between urban centres and rural areas (Geschiere & Gugler, 1998; Owuor, 2004). It has been argued that these urban-to-rural remittances are much more frequent than international remittances. A recent survey conducted by Finaccess (2007), for example, found that in the past 12 months, 33.4% of respondents had sent or received money from persons within Kenya while 3.5% had sent or received money from persons outside of the country. Because a large proportion of urban-to-rural remittances are being sent through informal channels, there are significant inaccuracies and gaps in the official records. However, there have been some empirical studies that have traced remittance patterns in various parts of Kenya. These studies will be reviewed in this section.

In a study conducted in Western Kenya, Hoddinott (1994) found that 86.8% of respondents had remitted money or goods back to the village at least once in the previous twelve months. In a later study Owuor (2004) found that 35% of respondents in Nakuru town would send money back every month, while 41% would send money back every two to four months. It has also been argued that Kenyans remit a high percentage of their incomes to the rural area. Rempel et al. (1970) conducted a study of recently migrated males in eight urban centres and found that 13% of their income is remitted back to the rural area. In a study conducted in Nairobi, Johnson and Whitelaw (1974) found that the average amount remitted is 21%.

According to the literature, remittances are made in both cash and kind. It is common for migrants to send urban-type items, such as furniture, wall clocks, and radios back to the rural. Empirical research suggests that clothing is most frequently remitted (Oucho, 1996). Some migrants also send building supplies so that improvements can be made on the land. Such remittance flows are multi-directional. Money and other goods are not just flowing from the city to the village, but also from the village to the city. Oucho (1996) traced the flow of remittances between Nyanza province and urban areas. The author found that 73% of all remittances were urban-to-rural while 26.7% were rural-to-urban. When visiting it is very common for migrants to accumulate goods from the village and bring them back to the city. These goods are either used for consumption or re-sale when the migrant returns to the city. Flows of money from the rural to the urban have also

been documented. This money is used by migrants when they are settling into the city and looking for employment. It is also used by college and university students to pay for school fees and related costs.

In Kenya, a variety of channels are used to transfer money between urban centres and rural areas. The ones most popular amongst low-income Kenyans are the informal channels. For example, it is very common for Kenyans to send money to the rural via friends and family. According to Fincccess (2007), 58% used this channel to transfer money. This method is popular because it is the cheapest. There is no set fee and the cost depends on the agreement made those involved in the transfer. However, half of the respondents in the survey also claimed that this method is the riskiest. They complained that money and goods often failed to reach the final destination. They further asserted that, when possible, they preferred to make the transfer themselves. The same study found that bus and matatu companies are also frequently used. These companies are not, however, licensed to transfer money. As such, it is common for senders to not declare that they are sending money and enclose it in envelopes or parcels. Although there is some risk of loss and theft, this method of money transfer is popular among low-income constituents because it is reported as reliable. These companies also have extensive reach into the rural areas. Finally, the post office is also frequently used for money transfers. This channel also has an extensive reach into rural areas and is inexpensive. However, many survey respondents complained of unreliable service and delayed transfers. They further asserted that it was difficult to access larger sums of money, especially in the rural areas.

There are thus a variety of channels available for the movement of money between the city and the village. However, as will be discussed in the next section, the M-PESA application is providing an alternative to these various channels. It is also radically changing the way that migrants in Kibera remit money back to the rural.

4. INTRODUCING KIBERA

Kibera is one of the most impoverished areas in Kenya. It is located 7kms southwest of Nairobi and it is estimated that one million people, or 60% of the population in Nairobi, call Kibera their home (Ilako & Kimura, 2004). The slum is mainly populated by migrants from various parts of Kenya. These migrants come from a variety of ethnic communities, although the Luo and Luhya are reported to be the largest. Most of these migrants are tenants and thus do not own land in Kibera (Ishihara, 2003). For this reason, it is common for residents to frequently move in and out of, as well as within, the slum.

The unemployment rates in Kibera are some of the highest in the country. Only 17% of the adult population is reported to be permanently employed (Ilako & Kimura, 2004). The rest are casual labourers or employed in the informal sector. The health indicators in the slum are also extremely poor. It is estimated that 20% of the community is infected with the HIV virus (Ilako & Kimura, 2004). This is almost four times the national average.

Although Kibera is situated on property that is government owned, the social amenities are extremely poor. There are no all-weather roads in the slum, and traffic is brought to a stand-still during rainy periods. The majority of dwellers do not have electricity. Power supplies only exist along the main road and railway track. During the evenings the slum becomes engulfed in darkness and, because of the security risks, few residents leave their homes. Telecommunication facilities are also scarce. There are a few 'simu ya jamii' (community phone) facilities in Kibera. This allows residents to make, but not receive calls. Many of the residents in Kibera also have mobile phones.³ Because of the lack of electricity, these residents pay a small sum (10 Ksh) to have these phones charged in one of the shops along the main road.

There are no formal financial institutions within Kibera. The residents must travel into town to access the aforementioned money transfer services. This under-representation of these organizations could be explained by the lack of security within the slums. There is very little police presence in Kibera. Residents claim that the police only visit the slum to collect bribes. Although there were no financial institutions, there were five M-PESA agents at the time the study was conducted in Kibera. According to reports from Safaricom, the number of agents and the customer base is expected to increase rapidly in this context.

This location was chosen because, as mentioned above, it is populated mainly by migrant workers. These workers come to find work in Nairobi because there is little available in the rural area. This means that they are likely to have relations with the rural and a 'home' to which they return. They are also likely to transfer money back to their home. Because of the lack of financial institutions in this context, it would be interesting to examine if and how they use M-PESA to make such transfers.

5. DATA GATHERING TECHNIQUES

An ethnographic study was conducted in Kibera from September -December 2007. During this period, a shop offering M-PESA services was visited several times per week. The shop is situated

³ Please note that the researcher is still gathering data on how many people have a mobile phone in Kibera.

along Kibera Drive, the main passageway to town. It has been opened since 2006 and sells a variety of Safaricom products including scratch cards, SIM cards and mobile phones. The shop started offering M-PESA services in June of 2007. Time was also spent outside of the shop. The researcher visited the homes of the residents, markets, shops, health clinics, and schools. This provided the researcher with an in-depth understanding of the context.

Ethnographic methods—such as participant observation, semi-structured, and unstructured interviews—were used to collect the data. The study included three classes of individuals—users, non-users, and agents. It must be noted, however, that the sample of the users was predominantly male. This is because at least three-quarters of the customers were men. For the purpose of diversification, female customers were interviewed when possible.

Two research assistants were hired to help with the research. One of the assistants had lived in the slum since childhood and thus acted as a gatekeeper. He knew many of the people that would come into the shop. This facilitated the interview process with the M-PESA users. The interviews were conducted in English and Kiswahili. The researcher is proficient in Kiswahili but would receive help from the research assistants when needed.

Almost all of the non-users in the sample were friends, neighbours, or family members of the research assistant. The majority of them were Luhya, the ethnic group to which the research assistant belonged. The sample of interviewees in the shops, however, was mixed. Many of the respondents were Luhya, but a large segment also came from other ethnic groups such as the Kikuyu and Luo.

The study was put on hold in late December of 2007 because of the violence that was instigated by the disputed presidential elections. Businesses and homes were burnt and many residents fled Kibera. Because of this unfortunate situation, the researcher did not feel that it was safe to return to the slum.

6. THE RESULTS

As mentioned in the introduction, this study focuses on two research questions. This section will begin by addressing the first— *is the M-PESA application being used for the transfer of remittances between urban and rural areas?* The answer to this question is yes. The majority of the respondents claimed that they were using M-PESA to ‘send money back to the rural’. In fact, many did not know that the application could be used for any other purpose. When asked where

the money was being sent, the majority of the respondents claimed that they were sending the money to villages or towns in Western Kenya. Several locations were frequently mentioned. This includes the Kakamega district in the Western province, which is mainly inhabited by the Luhya. It also includes the Kisii and Kisumu districts in the Nyanza province, which are mainly inhabited by the Luo. As mentioned previously, a large segment of those living in Kibera are Luo and Luhya migrants from Western Kenya. It thus makes sense that money is being remitted to this part of the country.

When asked to whom the money was being sent, the majority of respondents asserted that they were sending money to family members. Men often claimed that the recipient of the transfer was their wife, or wives in the rural area. Many also claimed to be sending money to their mother. The majority of women, on the other hand, asserted that the recipient of the money was their Mother. None of the women interviewed told us that they were sending money to their husband. The respondents were also asked why they were sending money back to the rural area. The majority of them claimed that they wanted to ‘maintain’ their families. Many said that they wanted to make sure that their family members had enough money to purchase food and other necessities. Others claimed that the money would be used to make ‘improvements’ on the farm.

In regards to frequency, the majority of those interviewed said that they would send money back ‘regularly’. When asked what ‘regularly’ meant, different answers were given. Most respondents asserted that money was sent at least once per month. Others claimed that they would send money every three to four months. Some users also said that they would only send money back to the rural when they were requested to do so by their relatives. They explained that this would happen when the relatives were experiencing financial difficulties and could not ‘cope’ without assistance. M-PESA users were also asked if they expected the frequency with which they sent the remittances to increase or decrease in the future. Almost all the respondents claimed that this depended on employment. They explained that they would continue to remit back to the rural for as long as they were able to do so.

Some of the respondents also said that they would sometimes receive money from the rural. These were usually university students who were being supported by a group of relatives. Most of these students said that they were not working and thus depended on these remittances for survival. They claimed that they would ‘payback’ the money as soon as they started working. This confirms earlier research that remittances are multi-directional.

Not all respondents were sending money back to ‘maintain’ their families. Some claimed to have commercial and political interests in the rural. One man said that he owned a construction company with his sister in a small village close to Kisii. He came to Nairobi occasionally to make ‘extra money’. Every Sunday he would send this extra money back to his sister who would then invest it in the business. Another man asserted that he regularly used M-PESA for ‘political reasons’. He said that he was the chief campaigner for his political party in his rural district and would often transfer large sums of money from Nairobi to other members of the party. When the money was received, it was used to fund their political campaigns.

There were also other usages of M-PESA that should be noted. Many respondents claimed that they were using the application to store money, even if they already had a bank account. They said that they were too busy to travel into town to access their account. As mentioned above, there are no banks in Kibera. Others said that the banks ‘could not be trusted’ with their money because they were involved in ‘tribal politics’. They complained that the larger banks were funding the electoral campaign of the incumbent President, Mwai Kibaki, and said that if this continued, the ‘common man’s money’ would be lost. They said that they preferred to put their money into several accounts to minimize the risk. The respondents also used M-PESA to top-up their mobile phones, especially during the evenings. Many of the respondents said that they did not like to leave their home after dark. Others asserted that it was difficult to purchase mobile phone credit because the shops were closed. Finally, many of the younger respondents said that they used M-PESA to transfer small amounts of money to friends in Nairobi. They said that it was their ‘duty’ to send ‘a few hundred bob⁴’ to a friend in need. Although these various other usages were noted, it must be made clear that the majority of the customers were using M-PESA to send money ‘to the rural’.

Now that it has been established that M-PESA is being used for the transfer of remittances between the urban and the rural, the second question can be addressed—*why is M-PESA being used over other money transfer services?* Several of the respondents said that they started to use M-PESA because they were displeased with the other remittance channels. Sending money via friends and family was most often complained about. Many respondents asserted it was common for some or all of their money to go missing when this method was used. Those entrusted with the transfer would claim that the money was stolen by ‘highway robbers’, or that they had incurred ‘unexpected expenses’ along the way. The respondents said that with M-PESA, they

⁴ ‘Bob’ is slang for Kenyan shilling.

could send the money directly to the recipient in the rural. They did not need to rely on a ‘corrupt’ relative or friend for its delivery.

Some of the respondents claimed that they preferred M-PESA over the bus and courier companies because the transfer time was much shorter. They no longer needed to wait for the money to be physically transported. They also did not have to go into town, where most of the bus and courier services were located, to access the service. Many also complained about sending money via the post office. They said that on several occasions the recipients in the rural could not access the money. This was especially the case when a larger amount was transferred.

Many of those interviewed also said that there was an M-PESA agent in or near their village. This meant that the service could be easily accessed by the recipients. One man explained that he had to convince his Mother to sign up for M-PESA because there was no other way for the money to be sent. He said that the bus service in the nearest town was not regular. The post office had also been closed. Although his Mother did have ‘difficulty’ with M-PESA in the beginning, the man explained that she had now become accustomed to using the service.

It must be made clear, however, that not everyone preferred the M-PESA service for the transfer of remittances. One non-user interviewed said that M-PESA was ‘no good’ because it did not facilitate transfers in kind. She explained that many of her relatives were in debt and could not receive cash transfers because they would be ‘hassled’ by debtors for repayment. For this reason, she would send these relatives ‘gifts in kind’ such as clothing and use a courier service for the transfer. Others complained that they could not use M-PESA because their rural relatives did not have mobile phones, and thus could not access their money in the rural. Finally, many users complained that M-PESA was ‘no good’ because it took too long for the transaction to be completed. Because M-PESA utilizes the same data channel as text messages, it often becomes congested at peak texting times. The result is that the processing time for the transactions is long. Some customers even complained that they had to wait for one hour or more for their confirmation SMS to come through. Others claimed that they never received the confirmation SMS and needed to visit the agent to see whether the transaction had been processed.

Although some respondents were displeased with the service, the majority claimed that they preferred it over other channels. The argument can thus be made that the M-PESA application is being used by many urban migrants for the transfer of remittances. It can further be argued that the application is displacing many of the other remittance channels.

7. DISCUSSION AND SUGGESTIONS FOR FUTURE RESEARCH

Several conclusions can be drawn from this analysis. The M-PESA application is being widely adopted by low-income migrants for the transfer of remittances between urban and rural areas, and becoming a substitute for many of the other money transfer services. Because of these results, it can be argued that there is a gap in the remittance market in Kenya, and that the M-PESA application is beginning to fill this gap. But why is this application becoming so pervasive? To answer this question, literature on mobile phones in developing countries will be examined. Numerous in-depth studies of this technology have made an interesting argument—that mobile phones are pervasive because they fit into the already established needs and interests of low-income constituents (Donner, 2005; 2006; Horst & Miller, 2006). In other words, mobile phones are helping this segment to do what they were doing before the technology was introduced. A similar argument can be made for the M-PESA application. It is being widely adopted in Kibera because it is helping the migrants to transfer money between the urban and the rural. As was made clear at the beginning of this study, migrants were making such transfers long *before* the application was introduced. M-PESA is just making it easier for them to do so. They no longer need to travel outside of the slum to access a money transfer service, and they do not have to rely on ‘corrupt relatives’ for the delivery of the money.

Furthermore, it was argued that migrants transfer money to maintain relations with the rural. This is vital as it provides the migrant with economic and emotional security while they reside in the urban. It further provides the migrant with a ‘home’ to which they can one day return. This argument can be taken one step further. If remittances are vital for the maintenance of urban-rural relations, and M-PESA is being used for the transfer of remittances, then it can be argued that the application is becoming a tool for the maintenance of such relations. With each e-money transfer, the migrant is sending an important message—that they have not forgotten about their obligation to the village whilst residing in the city.

Such conclusions have prompted research questions that will be considered in future research. The first is related to the nature of urban-rural relations. If the argument is accepted that M-PESA has become a tool for the maintenance of such relations, then it would be interesting to examine the following—*is the M-PESA application changing the nature of urban-rural relations?* This question was promoted by an interview with a man who frequently sent money back to the rural via M-PESA. He said that before he used the application for transfers he would deliver the money himself because he did not trust the other remittance channels. He would visit the village several times per year to make this delivery. During these visits, he would also spend time with his

family. The respondent commented that he no longer needed to make such frequent visits because he could now use M-PESA to send money directly to his Mother's phone. This led the researcher to question if the nature of relations between the respondent and his relatives in the rural area would change because he was no longer making frequent visits. It also led the researcher to wonder how else this application is affecting relations between urban migrants and rural dwellers. It would also be interesting to investigate whether remittance patterns are changing because of the M-PESA application. It can be argued that such patterns are somewhat contingent upon the channel that is used for money transfers. The choice of channel could determine not only how much is sent, but also how often the transfer is made. For example, it was mentioned above that one disadvantage of using services such as bus companies is that they are located in town, which means that the resident of Kibera has to leave the slum to access these services. This could decrease the frequency with which the transaction is made. The cost of the transaction could also affect the frequency of transactions. M-PESA is one of the cheapest channels available. It costs 30 Ksh to transfer up to 35,000 Ksh to another M-PESA user. Because of this low cost, it could be argued that frequencies of transactions may rise. This also brings up the question of value. If frequency of remittances rises will the value remitted remain the same? If not then how will this change?

It can further be investigated whether the availability of the mobile phone has affected urban-to-rural remittance patterns. Before the mobile phone was pervasive in Kibera, it was very difficult for the migrant to be reached. The slum was poorly supplied with telecommunication facilities and very few residents had access to a telephone (Ishihara, 2003). Communication depended upon the delivery of messages via friends and family and the post. This made it difficult for the rural relative to make contact and request funds. Such requests can now be made much more easily because most of the slum dwellers interviewed had a mobile phone, or access to this technology. Because of this, it can also be argued that the migrant has more autonomy in deciding when to remit, and how much to send.

Finally, the reasons for the adoption of M-PESA should also be given consideration. In this discussion, the literature on trust in the context of exchange can be integrated. This will allow for an in-depth examination of why the urban migrants have chosen to store and send their money via M-PESA. It will also provide some insights into reasons for non-usage.

To conclude, a brief word will be said about the contribution of this study to the emerging discourse on m-banking in developing countries (Donner, 2007; Ivatury & Lyman, 2007; Ivatury,

& Pickens, 2006; Morawczynski & Miscione, 2007; Porteous, 2007). This study has shown that this technology is being widely adopted for the transfer of remittances but has said very little about the impact of such adoption and usage. Is this application fostering 'development' in the Kibera slum? If so, then how? The researcher believes that it is too early for such questions to be adequately answered. All that can be said at this point is that M-PESA is making life a bit easier for many in Kibera. By helping them maintain the complex set of relations in the rural, it is facilitating survival in the 'dual system'. Thus, at this early stage, it can be argued that the technology is becoming pervasive because it is fitting into old remittance habits. What type of new improvements will be engendered by the application is something worth investigating in future research.

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ICT Research in Africa: Need for a Strategic Developmental Focus

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Abstract

This paper argues the need to expand the research agenda on the use of ICT in African countries to include a stronger strategic developmental focus than is evident in much of the literature to date. Four strategic dimensions are identified where ICT arguably has potential as a significant enabler for transformational development in Africa: public infrastructure; governance, accountability and civil society; entrepreneurialism and economic activity; and access to global markets and resources. A representative set of literature on IS in Africa is classified along these dimensions, but an explicit focus on development is found to be lacking in most of this work. The four dimensions are then discussed in turn to describe their importance in the African context, to discuss some pathfinding research examples to date and to identify some directions for future research. The paper concludes with a call for IS researchers working on Africa to become involved in debate on national and international policy from an ICT perspective and to engage with other research communities in doing this, notably with those concerned with the field of African development.

Keywords: Africa, development, ICT, policy, IS research agenda

Introduction

We argue in this paper that there is something of a paradox in an unprecedented level of interest in the use of ICT for developmental aims within the African context, but little IS literature that actually engages with ‘development’ in any explicit way. Whilst there is a growing literature about ICT in Africa, much work to date has focused on ‘point’ implementations of ICT in African contexts, rather than seeking to inform policy concerning ways in which ICT can serve broader, more strategic developmental objectives.

In our view, this lack of a ‘strategic’, developmental focus in the literature to date may be in part because ‘development’ itself is an extremely contested concept, and explicit engagement with its aims requires a familiarity with the development literature, as well as a willingness to engage openly with other research disciplines. Furthermore, two additional difficulties exist in particular relation to ICT in Africa. First, the concept of ‘development’ has specific contours, or characteristics, within an African context, which need to be identified, discussed and established as valid and useful research themes by a growing ‘African developmental ICT’ research

community, and to our knowledge this has not occurred to date. Second, it is not always obvious where ICT is able to make a useful enabling contribution to these developmental aims in a continent where there are so many competing demands for scarce funding, and where supporting infrastructure can be so thin.

In response, this paper seeks to be specific about the need for a focus on ‘developmental’ ICT – as opposed to ICT that happens to be deployed within the context of developing countries. By ‘developmental’ ICT, we mean the conception, development, implementation and use of ICT as an explicit vehicle for furthering developmental aims – where ICT functions both as enabling artefact and enabled set of social behaviours (Thompson 2008). The potential of ICT in this regard has been acknowledged by some policymakers, for example UNESCO (2005)’s view of ‘knowledge societies’ as an accelerator for development or the recent attention given to the \$100 laptop, but it has also attracted some scepticism about the extent to which ICT is able to deliver lasting developmental benefits (e.g. Ciborra 2003) – or, indeed, whether precious developmental funding should be spent on ICT initiatives at all (e.g. Wade 2002). In the current context of unprecedented commercial and philanthropic interest in the topic of ICT in developing countries, such critiques are important and deserve serious engagement by the ICT community, which has yet to acknowledge and discuss explicitly the implications of a clear distinction between ‘developmental ICT’ and ‘ICT in developing countries’.

This paper aims to address these perceived difficulties, and is organised into three further sections. First, we look at a high level at how developmental ICT research arguably requires a shift in emphasis from more ‘traditional’ IS research to date, and explain why we believe this shift in emphasis amounts to a need for a more strategic engagement with policymakers and other research disciplines than has occurred thus far. Second, we identify some specifically ‘African’ developmental themes where ICT is arguably able to make an enabling contribution, explain why this is the case, and look at the extent to which each theme has been addressed thus far within the literature, with a view to establishing a broad, strategic framework for ‘developmental’ African ICT research. Finally, we conclude by highlighting briefly some of the implications of our findings for future research in this area.

The need for more ‘strategic’ research

Much IS literature to date has tended to focus along four dimensions: first, a concentration on an institutional, or inter-institutional, research frame; second, a focus on the design and particularly implementation of ‘point’ applications and ICT systems; third, a location of decision-making

about the purpose and shape of ICT as it occurs in the marketplace, and fourth, an engagement primarily with other ICT researchers and practitioners.

In contrast, we argue that an IS literature that aims to pursue a ‘developmental’ agenda needs to broaden, first, from an institutional to a global research frame to encompass a myriad of actors and their interests; second, from a focus on ‘point’ design and implementation to a wider critique that includes broader institutional, regulatory, and political infrastructures; and third, from examining ICT initiatives from a market-driven perspective to an engagement in strategic, policy-level debate about the transformative potential of ICT within broader developmental agendas. Finally, a ‘developmental’ ICT agenda calls for a committed engagement with literature, researchers and practitioners across a range of disciplines, implying a shift in the way in which ICT research is planned and conducted. These shifts in research focus are summarised in Table 1.

‘Traditional’IS focus	‘Developmental’ IS focus
Institutional ‘Point’ design and implementation Marketplace as locus of decisions about purpose and shape of ICT Other ICT researchers and practitioners	Global Broader institutional, regulatory, and political infrastructures Policy-level debate about transformative potential of ICT Researchers and practitioners from other disciplines

Table 1: A broadening of research focus

In arguing for a broadening of research focus across these areas, we also suggest that there is a continuing need for a sharp focus on ‘point’ implementations of technology to assess important factors such as overall relevance and cultural sensitivity – indeed, we would expect this need to increase as ‘developmental’ ICT issues gain further acceptance and attract more interest within the IS community. However, we are arguing for a broadening of the research agenda to include explicit engagement with the specific aims and implications of social and economic transformation, both areas that are relatively new to the IS research community.

International development organisations currently operate using strategies with which there is currently little or no engagement or critique from the ICT community. In seeking to engage with

this and other research communities involved in development, our proposed shift amounts to a more ‘strategic’ approach to conducting ICT research. Such an approach demands an explicitly outward-looking focus on ways in which ‘developmental ICT’ initiatives may profitably be embedded within – or perhaps in some cases be excluded from - broader structural transformational initiatives. Such a shift requires a longer term research aim: a move from a typical post-implementation review, concluding perhaps once again that an IT project should have been more sensitive to the needs of its local users, towards a research agenda that dares to challenge those in adjacent disciplines, to critique, and to plan. In so doing, we believe that the development of a political economy of ‘global ICT’ and, within this, of ‘African ICT’, may constitute a professionally risky undertaking, since a cautiously vigilant, yet underlyingly constructive approach may at times be more susceptible to claims from radical development scholars of naïve technological optimism than a view that remains consistently critical. However, we believe the risk is worth taking since the potential gains from the broadened focus are high in terms of potential relevance to crucial African development debates.

In an attempt to think about some useful underlying themes for a political economy of African ICT, we first identified some key areas of current debate within the ‘development’ community, and selected four ‘strategic’ dimensions where ICT arguably has potential as a significant enabler for transformational development in Africa: public infrastructure; governance, accountability and civil society; entrepreneurialism and economic activity; and access to global markets and resources. We then examined three survey papers in the IS in developing countries literature: Walsham and Sahay (2006), Avgerou (2007) and Walsham et al (2007). We identified all the articles cited in these survey papers that had an explicit focus on ICT in Africa. We would emphasise that we did not intend our work to be a complete survey of the literature on ICT in Africa, but we believe that we have used a broadly representative sample of current work in the area.

The results from our analysis of the above papers is given in the Appendix. In summary, we were able to classify the papers under the four developmental dimensions, with papers being oriented, for example, to infrastructural areas such as health, civil society issues such as educational provision, entrepreneurial activity or access to global markets. However, it is clear that most of the papers did not contain any explicit discussion of the strategic developmental contribution of the ICT-based initiative or that such discussion was rather limited. Only 5 papers in the whole set made a substantial effort to address development in an explicit way and to discuss the ICT contribution related to this. We repeat that this is not an argument that the rest of the papers were

of low value, since we believe that ‘point’ implementation studies are potentially of high worth. Rather, we are arguing that increased work on the strategic developmental dimensions is needed in addition to such ‘point’ studies.

The following section provides more detail on our strategic developmental dimensions by describing each dimension in turn, and by using some early ‘pathfinder’ examples from the existing literature to illustrate a broad range of issues that we believe constitutes a substantial stream of potential future research in each case. Some of the literature examples are from the cited papers above but we also draw on other papers from the literature, including some with a non-African focus. In discussing the dimensions, it is important to note that we are aware of the extreme country-level variation within Africa and that this cannot be treated homogeneously: rather, our intention is to highlight the importance of ICT as a potential strategic enabler within this broad context, whilst acknowledging that the significance of our dimensions will vary across locations.

Four ‘strategic’ dimensions for ICT research in Africa

ICT as enabler for Public Infrastructure

Most African countries suffer from inadequate or dilapidated public infrastructure with some of the lowest levels of service provision and availability in the world, with the ratio of services per head of population often declining with increased population growth. Although ICT may have limited potential for improving, say, transport networks and utilities, there is growing evidence of ICT’s ability to play a significant enabling role in areas such as public health and communications – usually when planned and used as part of a broader, structurally integrated, set of developmental interventions. For example, Ngwenyama et al. (2006) argue that “complementary investments in ICT, health and education can significantly increase development” – underlying the need for future work on how ICT initiatives may be further embedded in cross-sector developmental planning.

In the case of public health, considerable work has been conducted by the Health Information Systems Programme (HISP) across several African countries in demonstrating the impact that ICT is able to achieve in enabling people at primary level to take greater control of their own health information – and to plan and execute better-targeted clinical interventions as a result. In their recent MISQ article, Braa et al. (2007) discuss their experience of using flexible standards in generating a unified health information infrastructure, using actor-network theory to explain how this is generated. In our view, this represents a good example of how concepts used within the IS

literature can be applied usefully to the African developmental context.

Communications are another area to have received some attention within the literature, most notably in relation to the provision of telecentres to provide public access to long-distance communication and information services. In her recent, critical, discussion of the sustainability of telecentre projects in Kerala, India, Madon (2005a) notes that over 20 projects have been implemented in Africa in Ghana, Mozambique, Uganda, Benin, Tanzania, Zambia, Zimbabwe, and South Africa. However, Madon points to five critical issues that have affected the sustainability of the Keralan telecentre project: building corporate confidence, working with government, renewing grassroots campaigning, involving the legislative system, and ensuring the continued support of political champions.

We suggest that the above examples alone are a rich illustration of some of the questions for researchers investigating IS as an enabler for public infrastructure. If ICT is able to contribute to the development of much-needed public infrastructure in Africa, to what extent does African ICT share the sustainability issues raised by Madon? How might it be possible to ensure that ICT infrastructural projects are integrated effectively within other structural developmental interventions? How might we draw upon existing concepts from within the IS literature, such as flexible, open standards, to better understand the way in which to build sustainable infrastructure within the context of African 'development'? And how can such ideas engage with mainstream developmental policy-making?

ICT as enabler for Governance, Accountability, and Civil Society

Often manifested in 'urban bias' (e.g. Lipton 1982) and patrimonial behaviour (e.g. Callaghy 1987), developing good governance and accountability within the African state has long been an issue for debate within African development. It continues to be a major focus for donors, as exemplified by the World Bank's 'Worldwide Governance Indicators' (World Bank 2007), in which the Bank claims a 'development dividend' whereby improvements in governance by one standard deviation result in long-term increases in income of three-fold, and a two-thirds decline in infant mortality. Here, 'development' can often be seen as opposing the interests of entrenched institutional actors who may profit from controlling access to national resources. For example, in the African telecommunications field, Wilson (2004) cites the entrenched interests of regulators, ministry officials, and telephone company managers 'against' those trying to achieve rapid diffusion of access to ICT infrastructure.

The pervasiveness of this 'anti-state' view makes Al-Jaghoub and Westrup's (2003) work on the

role of the ‘competition state’ in driving ‘ICT-led development’ especially interesting. The authors show how, far from opposing the development of ICT infrastructure, the Jordanian state has succeeded in playing a pivotal role in assembling a mix of public and private partnerships, international agencies and multinational enterprises in the creation of a Jordanian ICT sector. Although Jordan’s political and cultural background differs markedly from those of, say, countries in sub-Saharan Africa, these states’ relative ‘disconnection’ from economic activity would suggest the usefulness of a networked approach to examining their ability to mobilise diverse actors to drive ICT-led development.

Furthermore, Thompson (2008) argues that increased participation by citizens in web-based, Web 2.0-style forms of interaction results over time in a corresponding growth in the culture of openness and increased transparency, where choice of information is arguably generating a “new economics of intellectual property” (Tapscott and Williams 2006). The recent impact of the leaked 2004 Kroll report into corruption in Kenya – published and available in perpetuity on the web – illustrates the power of ICT-based fora as a force for openness and political accountability. Taking a further Kenyan example, www.mzalendo.com (sub-titled ‘Eye on Kenyan Parliament’) illustrates the ability of ICT to support Kenyans’ unprecedented ability to interact around and critique the operation of the state.

There are also encouraging signs that involvement in e-government initiatives can result in an improvement in state-society relations. For example, in her study of the developmental impact of e-government initiatives in India, which she finds to be questionable, Madon (2005b) nonetheless points to an “increased sense of trust and reciprocity developing between citizens and the state...the government is seen for the first time as being capable of providing a reasonable level of service without corruption”. Given similar governance and accountability challenges within the context of many African countries, it would seem that there may be an opportunity for valuable research into the effect of e-governance initiatives as catalysts for improving trust between African states and their citizens.

Finally, as illustrated so clearly by Castells’ (1997) examples of the way in which ICT-enabled networks have fostered social movements such as Mexico’s Zapatistas, opportunities exist to look at ways in which social groups that feel excluded from the benefits of mainstream ‘development’ are able to use ICT to mobilise and co-ordinate their activities. In their study of Kenyan women’s participation in IT education programmes, Mbarika et al. (2007) note that “the majority of the women were motivated to attend the ICT programmes due to reasons related to gender equality”.

In an example of the enabling potential of ICT in building educational infrastructure, Komen (2007) describes the efforts of Schoolnet Namibia, a ‘bottom-up’ organization committed to empowering children across Namibia through open source software, open content, and open access. Schoolnet Namibia’s profile has now grown to the extent that the Namibian government has begun to recognise the power of this model in its national policymaking. We believe that there is a significant opportunity for future research projects on examining ways in which disadvantaged or excluded social groups in Africa are able to make use of ICT to increase their profiles and further their own developmental aims.

It appears from the above examples that there is significant opportunity for further strategic thought about the ability of the ICT sector to catalyse greater state involvement in economic development, and to foster higher standards of accountability and openness. Similarly, greater openness and accountability are unlikely to materialise in the absence of increased demands for such improvements by a strengthening, more vocal civil society. To be sure, significant questions remain around the unique challenges of many African state-society relations – and around the extent to which ‘connected’ urban elites are able to use ICT to ‘drive’ greater accountability for the benefit of the ‘disconnected’ rural majority – but these are surely questions deserving of researchers’ urgent attention, rather than a platform for the wholesale dismissal of developmental ICT as a fad.

ICT as enabler for Entrepreneurialism and Economic Activity

Jagun et al (2007) highlight the significance of ‘informational challenges’ such as absence, uncertainty, and asymmetry in hindering Nigerian microentrepreneurs’ ability to assemble supply chains, keeping them slow, costly, and risky. As argued earlier, a fragmented, inadequate public infrastructure is a particular issue for most African countries and therefore the potential ability of ICT to overcome or bypass uneven social, economic or geographical topographies to generate economic opportunity across both formal and informal sectors should constitute an important area for African ICT research.

In the formal sector, there has been a relative lack of studies that examine ICT implementation and use in large organisations within the African context, and even less that then go on to consider ICT’s role as developmental catalyst within this context. Where such studies exist, they often seek instead to highlight the organisational, economic, social, political, and cultural factors that influence the implementation and use of ICT. For instance, Bada (2002) uses the example of an IT-driven change programme in a Nigerian bank to (rightly) highlight the need for greater work

on understanding the local context into which global IT-based practices are being implemented, and Macome (2003) draws similar conclusions in an analysis of the implementation of IS in the Mozambican Electricity Company. However, although both authors touch upon the link between ICT and the effects of globalisation, neither deals with the issue in any systematic way.

More work appears to exist on ICT's potential as economic catalyst in the informal sector. For example, Thompson (2008) cites documented examples of entrepreneurial activity having been triggered by mobile technology in its ability to reduce transaction costs within cash-based societies, broaden trade networks and reduce the need to travel (Opoku-Mensah and Salih 2007). A survey (Donner 2005) of mobile phone users in Rwanda suggested that mobiles are allowing microentrepreneurs in developing countries to develop new business contacts on a peer-to-peer basis in a variety of ways. Most interestingly, Mbarika et al. (2007) describe Kenyan women's "highly optimistic" perceptions of ICT as a vehicle for achieving entry into the labour market – opening the way for further studies into ICT's differential effect on the fortunes of various stakeholder groups within the African context – and of the most appropriate way in which to plan for, and manage, favourable outcomes in each case.

The importance of mobile technology, in particular, in fostering economic opportunity is receiving increasing acknowledgement within the literature, as exemplified by Duncombe and Heeks' (2002) commitment to the underlying potential of shared telephone services for breaking the insularity experienced by rural entrepreneurs in Botswana. However, here, too, significant questions exist. For example, Jagun et al (2007) point out that whilst mobile technology has delivered some efficiencies and savings for microenterprise in Nigeria, there is often a continuing need for face-to-face interaction – and that mobile may even be opening up a 'competitive divide' between those with and those without access to telephony. There thus would appear to be a significant need for further research into the contextual implications of ICT as an enabler of competitive activity within African economies, that deepens our understanding of its potential economic benefits at the same time as our awareness of its limitations. How might IS researchers contribute to this discussion by drawing upon some of the existing work within the IS literature on power relations, and on the limitations of technology as a replacement for social interaction?

ICT as enabler for Access to Global Markets and Resources

The ability of technology-enabled network access to transform the lives of individuals around the globe – irrespective of location – was thoroughly described by Castells (1998), who examined the social and economic impact of such access in terms of inequality, polarisation, and social

exclusion – as well as in terms of the considerable opportunities also presented by ICT for addressing these. Often focusing on the African context, Castells discusses a range of ways in which ICT-enabled access to global markets and resources is able to improve the life chances of individuals and groups, from sidestepping intermediaries in order to gain more direct access to global markets, to making use of the internet to develop, spread, and gain global recognition for group identities and associated social movements.

In highlighting the ambiguous, double-edged nature of global networks as both transformational and constraining, Castells usefully illustrates the breadth of opportunity available to researchers interested in examining ways in which ICT-enabled access to global markets, resources – or even a global audience – is able to both positively and negatively affect quality of life. Within the African context, for example, Okunoye and Karsten (2003) point to the ways in which internet access has been changing the lives of researchers in sub-Saharan Africa – in the acquisition of knowledge (via the internet), knowledge transfer and sharing (principally via email), and in the ‘use’ of knowledge (the greater international presence that electronic publishing brought to their work). However, they also point to a series of issues and hindrances – relating chiefly to the African context – that need to be addressed within this sector.

We have already commented on Al-Jaghoub and Westrup’s (2003) work on access to global networks as a key part of Jordan’s approach to ICT-led development but their work is also notable for its emphasis on the economic benefits which arise from this access to global markets. In a related vein, Sayed and Westrup (2003) looked at how ERP systems supporting a group of high-technology companies in Egypt facilitated access to global markets and resources, thereby gaining increased economic benefits for Egyptian firms and supporting Egypt’s development goals. ICT-enabled access to global markets and resources thus arguably offer significant breadth of economic and social opportunity for individuals and groups across a range of activities, including defining and mobilising social movements, improving traders’ market awareness and bargaining position, and accessing and publishing information and knowledge. However, Molla (2000) cautions about the “hype both in the academic and popular media about the shift to the global information economy”, pointing out Africa’s unique challenges in participating in global markets and resources – and this continues to be the case, with less than 4% of Africa’s population connected to the web, the majority of these being in Northern African countries and South Africa (Nixon 2007).

There would therefore appear to be a set of questions surrounding both the enablement of greater

‘global connectivity’ in Africa, and the ways in which such connectivity may practically be put to use across a variety of disciplines, and types of data exchange. In the case of the former, there must be ongoing questions about the relative priority of ICT-enabled connectivity as a developmental aim in places where many lack, say, clean drinking water and access to basic health services – as well as a need to encourage a continuing awareness that connectivity may result in losers as well as winners. In the case of the latter, however, we believe that the ongoing development and trialling of new, practical applications involving global connectivity within the African context constitutes one of the most exciting avenues for future research – including action research – in the field.

Conclusion: Towards a research agenda for African development

In our paper we have called for those of us undertaking ICT-related research within the context of ‘African development’, as opposed to just ‘Africa’, to consider broadening the subject, as well as the focus, of our work to include an explicit engagement with the transformatory aims of development. In addition to critiquing ‘point’ implementations and projects, we need to be willing to engage with and critique international and national development policies from an ICT perspective, as well as contributing to ICT policy within individual countries. In so doing, we will need to build a body of empirical evidence that explores the potential direct and indirect developmental benefits of ICT in Africa, and develops our understanding of how these can be enjoyed by the greatest number. We must also remain vigilant about overly optimistic claims for the developmental potential of ICT in Africa, and of naïve attempts to ‘transfer in’ ICT to African contexts regardless of cultural relevance or sustainability.

We will also need to identify and engage with other research communities, their literatures, and theoretical constructs, whilst asking how some of the valuable insights developed within the information systems literature may complement some of these perspectives. Finally, we will need to accept that ‘development’ is an analytically complex and politically problematic set of aims, and that active participation in its shaping and implementation amounts at times to a political statement in itself, requiring a willingness to occupy and defend a particular position. However difficult and complex ICT has proven to date to be in Africa, and however problematic the field of ‘African development’, we believe that the two fields are likely to become ever more intertwined, and deserve a committed body of research capable of acknowledging and illuminating the strategic relationship between the two.

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Appendix: Some Articles in the ICTs in Developing Countries Literature with an Explicit African Focus

Articles cited in Walsham and Sahay (2006):

Author(s) [and country of study]	Public Infrastructure	Governance, Accountability and Civil Society	Entrepreneurial and Economic Activity	Access To Global Markets and Resources	Explicit Discussion of Strategic Contribution to Development?
Bada (2002) [Nigeria]			Local bank's adaptation of ERP system	ERP systems as global resource	No, but some discussion of global-local dialectic
Braa and Hedberg (2002) [South Africa]	Health	Bottom-up empowerment of health workers			Yes – discusses contribution of HISP approach to South Africa's post-apartheid development policies
Mursu et al (2003) [Nigeria]			Software development		No, but some discussion of how Nigeria is different to developed countries
Okunoye and Karsten (2003) [Gambia and Nigeria]		Education		Access to global resources through the internet	Limited – some discussion of the importance of the education sector to development
Sayed and Westrup (2003) [Egypt]	National project for technological development		ERP systems supporting group of high-technology companies	ICTs facilitating access to global markets and resources	Yes – discusses links of ICTs with Egypt's development goals
Shoib and Jones (2003) [Egypt]					No – focussed on relative weaknesses of current IS research on Egypt
Thompson (2002) [South Africa]	Health				No – little discussion of contribution of health to development goals

Articles cited in Avgerou (2007):

Author(s) [and country of study]	Public Infrastructure	Governance, Accountability and Civil Society	Entrepreneurial and Economic Activity	Access To Global Markets And Resources	Explicit Discussion of Contribution to Development?
Al-Gahtani (2003) [Saudi Arabia]			Technology adoption by companies		No – except to imply that IT use is a good thing for Saudi Arabia
Al-Jaghoub and Westrup (2003) [Jordan]		Jordan's efforts to become a competition state	Technology supporting export-led growth	Technology to provide access to global markets and resources	Yes – discusses Jordan's development philosophy and the role of ICTs in this
Kenny (2000) [Africa in general]		Internet to help the rural poor			No – except to assert that internet access would be helpful to the development of the rural poor
Mbarika et al (2007) [Kenya]		ICTs to empower women			Yes – argues that women's empowerment can be related to Sen's concepts of development as freedom
Molla (2000) [Africa in general]	At a very general level		At a very general level		Limited – accepts that ICTs are a good thing for development without any serious questioning
Ngwenyama et al (2006) [Five West African countries]	Health	Education			Limited – derives causality from statistical correlations between ICT investments and those in health/education with HDI
Rose and Straub (1998) [Five Arab countries]			A very broad level of the TAM model		No – implicitly accepts that technology adoption is a good thing
Straub et al (2001) [Arab world]			A very broad level of whether particular 'cultures' affect technology acceptance		No – implicitly accepts that technology adoption is a good thing
Warschauer (2003) [Egypt]		Educational system			Yes to some extent – discusses the link between the digital divide and the broader complexity of socio-political realities
Wresch (1998) [Africa in general]		Educational system, role of the media etc.		Brief discussion of access issues	Limited – argues that more local films, books etc would be a good thing
Zakaria et al (2003) [Arab world]			A very broad level through hypotheses as to how culture affects technology adoption		No – implicitly accepts that technology adoption is a good thing

Articles cited in Walsham, Robey and Sahay (2007):

Author(s) [and country of study]	Public Infra-structure	Governance, Accountability and Civil Society	Entrepreneurial And Economic Activity	Access To Global Markets And Resources	Explicit Discussion of Contribution to Development?
Korpela et al (2000) [Nigeria]	Health	To some extent – by trying to mould an approach to system design which is congruent with the local socio-political context			Limited – largely implies that ICTs are a good thing
Macome (2003) [Mozambique]	Electricity company				No – discusses implementation issues but doesn't really touch on development as such

Towards an inclusive approach to e-Governance: A Case for Administrative Justice in South Africa

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Abstract

Impartial, fair and reasonable decision making by public institutions in South Africa as advocated for in administrative law, still faces significant challenges. In this paper, we propose a different approach to the implementation of the Provision of Administrative Justice Act. Based on previous research and government reports which highlight the lack of capacity within communities to participate in administrative decision making, this paper presents a theoretically informed approach for e-governance as a way of getting feedback and as a way of discussing existing services. Toulmin et al's schema of reasoning and Courtney's decision making paradigm form the theoretical basis of the framework. The process embedded in the framework can be facilitated by specially designed decision support systems which create a forum in which clarity can be obtained on service delivery problems and different perspectives on solving them can be elicited.

1. Introduction:

Between 1948 and 1994 South Africa was governed under a policy known as apartheid. Apartheid, which literally means *apartness*, was a system of legalized and enforced segregation between races. In apartheid, decision making was highly autocratic and non-negotiable. Absolute authority centralized to a small minority resulted in a grossly inefficient, mismanaged and corrupt South African public service system. As a result of this period, significant divisions were created within society. These divisions had a considerable impact on the functioning of public service institutions, created tensions between different races and ethnic groups, and led to a low trust within society of public institutions (Askvik and Bak, 2005). Thus, although the first democratic election of 1994 and the 1996 constitution initiated a process of decentralization and increased accountability, they brought with them profound demands on the government as well as the citizens for radical transformation (Rakate, 2006). A number of legislations and policies have since been passed to redress this situation in South Africa.

The transformation of the public service formally began in 1995 with the release of the White Paper on the Transformation of Public Service (Republic of South Africa, 1995), hereafter abbreviated to WPTPS. The WPTPS established the institutional framework that could guide the introduction of new policies and the implementation of the new constitutional mandates. It was shortly followed in 1997 by the White Paper on Transforming Public Service Delivery, labelled as the Batho Pele White Paper (Republic of South Africa, 1997). Batho Pele, a Se-Sotho term meaning “People First”, is based on eight national standards of consulting users of service, setting service standards, increasing access, ensuring courtesy, providing more and better information, increasing openness and transparency, remedying mistakes and failures and getting the best possible value for money (South Africa, 2006). The Batho Pele White Paper is specifically aimed at promoting integrated and seamless public service delivery. These two policy papers set the stage towards radically transforming the previously dysfunctional system.

In this paper we draw attention to an act whose primary purpose is to promote fair and impartial decision making as part of service delivery by government administrators; the Promotion of the Administrative Justice Act (PAJA) (Republic of South Africa, 2000). The PAJA is the core legal framework that guides the Batho Pele government policy on public service delivery. PAJA states that everybody has the right to fair, lawful and reasonable administrative action, and that reasons should be given to them in cases where administrative action affects them negatively. As such it brings into effect the right enshrined in the Constitutional Bill of Rights to ‘just’ administrative action. However, the government has struggled to implement the PAJA since its inception in 2000 primarily citing capacity problems (Republic of South Africa, 2001, , 2002, , 2004, , 2005, , 2006, , 2007). We argue in this paper that a more theoretically informed implementation strategy could have a profound effect not only regarding the citizens’ awareness of their rights and the taking of action accordingly, but also in terms of the capacity of the administrators to act in a manner adhering to the act. This finding is based on previous research on the use of Decision Support Systems (DSS) for the dissemination of information pertaining to citizen’s rights as laid down in the PAJA (Twinomurinzi and Phahlamohlaka, 2006).

The main objective of this paper is to explore the theoretical arguments which can be made regarding the implementation of the PAJA and as such does not deal extensively with the details of the previous research which has been written up elsewhere (Twinomurinzi, H. and Phahlamohlaka, L.J, 2005; Alexander, P.M. and Phahlamohlaka, L.J, 2005; Wooding, T. and Phahlamohlaka, L.J, 2005). However, based on this theoretically informed framework we believe that a more informed practical implementation of PAJA will result. In this respect we explore the implementation of PAJA aided by DSS and reasoning processes.

In the rest of this paper we briefly explore the PAJA and the research project on which we build. We then (Section 3) describe the conventional approach to DSS and a more holistic approach which is needed if DSS are to be used to assist in the implementation of the PAJA. Within the DSS it is also important to explore how decisions are justified and supported. This process of reasoning also has implications for the implementation of the PAJA (Section 4). The implications of applying the new paradigm to DSS (Courtney, 2001) and using a schema of reasoning (Toulmin et al., 1979) in relation to the PAJA are then discussed in Section 5. Section 6 concludes this paper on how the implementation of the PAJA can benefit from taking a broad holistic view to decision-making around the PAJA.

2. The Promotion of the Administrative Justice Act

Despite the evident heavy investments in promoting Batho Pele nationwide, public service delivery as a collaborative approach still remains a significant challenge (Harris, 2006, Legoabe, 2004, Government of South Africa, 2006, Government of South Africa, 2007). In most instances, both the public servants and the citizens do not know how to operationalise Batho Pele; both groups do not know how to translate these principles into day to day practices primarily because they lack the skills to do so (Deputy President, 2007) and because many citizens remain suspicious of the government (Twinomurinzi and Phahlamohlaka, 2005). Public service delivery hence remains the traditional one way communication channel from the government to the public. The collaborative paradigm prescribed by Batho Pele for government–citizen interactions remains a vague philosophical ideal. The specific case of the PAJA illustrates this.

The promulgation of the PAJA means that theoretically a South African citizen has the opportunity for their arguments or 'their side of the story' to be aired to public administrators before any decision affecting them is made. Once a decision is made which negatively impacts on a person, reasons in writing need to be given within 90 days if requested. The outcome should be that a person should know why administration has made the decisions they have, even if they do not agree with the outcome. For the administrator it implies that they must follow fair procedures when making decisions; explain the decisions they take; explain any internal appeal process that may exist within the department; explain that the applicant can ask a court to review the decision, and; lastly, that written reasons for the decision must be given if requested. The PAJA only relates to decisions which negatively affect people's rights. This can be in terms of decisions taken that affect the individual directly, but also decisions affecting sections of the public, for example building a road through communal land. Thus the PAJA is fundamentally about decision making processes within a social environment and the rationale or reasoning behind those processes.

In terms of the process of decision making there are two main reasoning processes which take place. The first is in terms of the applicant having the capacity to air their own views and reason as to why they should be given the requested service. The second relates to the strengthening of the capacity of the administrator to give reasons for the decisions made. Interestingly in the documents which support PAJA (Government of South Africa, 2000, German Development Cooperation (GTZ) and Department of Justice/Justice College, 2002, Department of Justice, undated), though there is a clear process on how to make a challenge, most of the documents on decision making focus on the administrator giving reasons for their decisions rather than on the client giving their reasons for their decision on why they applied for that service. These two perspectives are now explored in further detail.

Under the PAJA a person can challenge decisions if the correct procedure was not conducted and as such can hold administrators accountable for decisions which negatively affect their lives. However, such requests for decisions must be in writing and within 90 days of the decision being made. Some enquiries will take place within the Department, for example, the Department of Home Affairs has an Appeal Board. If not, then the person can take the decision to court. Given the expense of this a

number of alternatives are suggested by the Department of Justice: writing a letter to the relevant Minister or Director-General, finding NGOs, CBOs and Paralegals in the area that could assist, contacting the Public Protector in cases where corruption is suspected, using the Human Rights Advice Line, Legal Aid Board and Justice Centres. This assumes a persons' capacity in terms of developing coherent arguments before the application is made and/or when contesting a negative decision which has been made.

From the administrators' perspective fairly clear procedures are outlined for the administrator to follow in making a decision. These include:

- Before taking a decision the administrator must tell the people whose rights are affected what they plan to do and give them time to reply.
- After taking a decision, administrators must provide a clear statement on the decision made, information on any internal appeal and review process, and inform the person that they can request reasons for the decision.

Unlike the client there are guidelines available on the website (<http://www.doj.gov.za/2004dojsite/paja/new.htm>) on how the administrator should reason their decisions (German Development Cooperation (GTZ) and Department of Justice/Justice College, 2002) and the Draft Code of Good Administrative Conduct explains what is deemed good conduct (Department of Justice, undated). An example of a standard letter which could be used by an administrator to justify the decision made is given, though it is recommended that such standardised forms are not used. There are guiding principles given on what to include in such a written response. These include:

- A clear decision must be set out;
- Details of the person who took the decision must be given;
- Adequate reasons for the decision must be given; and
- Information must be provided on any legal remedies available.

Based on previous research by Twinomurinzi and Phahlamohlaka (2006), e-collaboration technology can be used to facilitate collaborative government-citizen interaction in the implementation of policy and to improve service delivery. Their work is based on an ongoing six year longitudinal interpretive research project into

identifying and harnessing opportunities for sustained collaboration and interaction by communities through the use of web-based Group Support System tools within e-government contexts in South Africa (Twinomurinzi and Phahlamohlaka, 2006). Three years of this project have been completed. The preliminary results suggest that an e-collaboration approach, Collaboration Engineering using thinkLets, when used as an enabler in a role playing scenario which utilises practical examples, can lead to the buy in of government development innovations in communities through collaborative government-citizen interaction (Twinomurinzi, 2007, Twinomurinzi and Phahlamohlaka, 2006).

Three field locations in three different Provinces in South Africa were selected to carry out exercises using these Group Support Systems. These included; Siyabuswa in the Mpumalanga Province (hosted by SEIDET), Lebotloane in the North West Province (hosted by Leretlabetse Multi Purpose Community Center) and several Civil Society organizations (hosted by the University of Pretoria) in Gauteng. The sites were chosen in terms of availability of networked computers, proximity to the University of Pretoria and commitment from local leaders within the hosting institutions. Twenty participants from the local community were selected by the community leaders and comprised government officials, community leaders, students, pensioners, and social workers and those who were likely to attend. The formulation and implementation of the e-collaboration approach, Collaboration Engineering using thinkLets, occurred in these workshops.

What stood out from these research workshops was the little knowledge surrounding the PAJA and the lack of capacity to promote it. How to overcome these gaps using DSS is the focus of the on-going research. This paper broadens this research to investigate how theories relating to decision-making and DSS can inform e-collaboration within the Batho Pele philosophy for the improvement of service delivery in South Africa through collaborative government-citizen interactions. In this paper we argue that the research requires an understanding of conventional approaches to DSS (Section 3) and the justification of decisions (Section 4).

3. IS Supported Decision Making

IS researchers investigating DSS are increasingly becoming critical of the past a-contextual stance of DSS (Gopal and Prasad, 2001, Kock, 2005, Briggs et al., 2003, Dennis et al., 2001, Vreede, 2006). Courtney (2001) particularly believes that there is the need for a new paradigm for decision making within DSS as contexts are getting more complex and ill-structured. This is largely attributable to the global nature of business and the call for more ethical/socially responsible business practices. The implications of more ill-structured global decisions on DSS are that data from outside the organisation is required, often social data - data about people. Consequently, relational databases, flexible query languages and flexible interactive modeling systems are needed (Courtney, 2001).

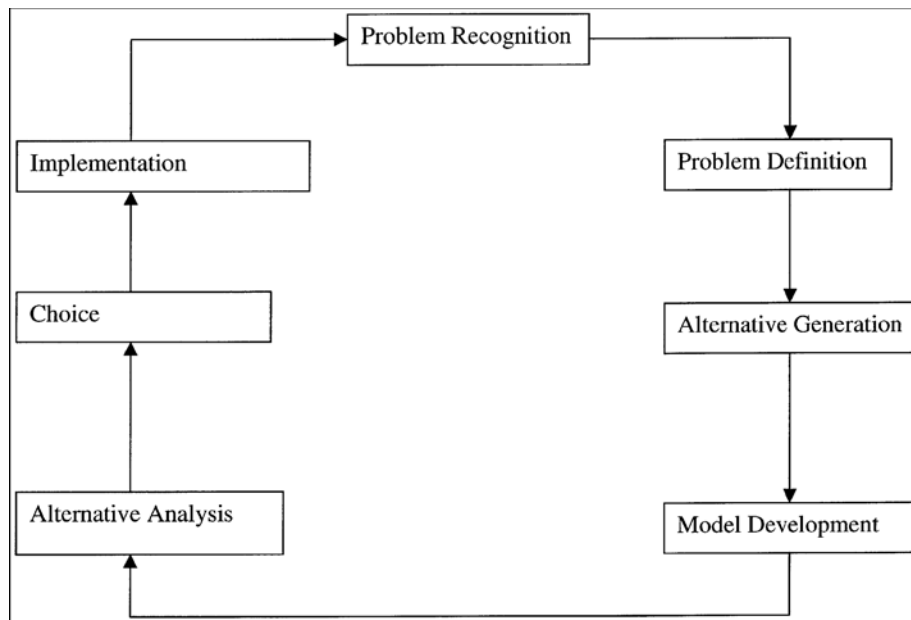


Figure One: The conventional DSS decision-making process

(Source: Courtney, 2001, Fig. 2 p. 19)

Courtney postulates that the conventional DSS decision-making process (illustrated in Figure One) is inadequate to deal with such complex problems as the conventional emphasis in DSS is on model development and problem analysis and consequently the reduction of the decisions to alternative technical/mechanistic solutions. Courtney argues that a more holistic approach to DSS is required where broad organisation and personal perspectives and ethical and aesthetic considerations can be

included with the traditional technical perspective. This Courtney illustrates as follows (Figure Two):

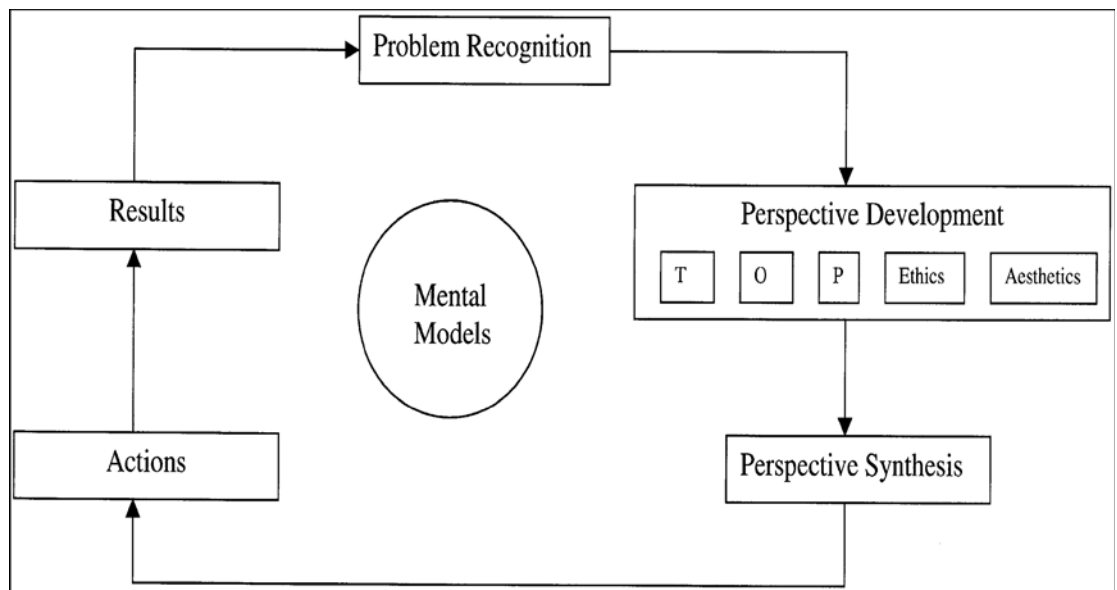


Figure Two: Courtney's New Decision-Making paradigm for DSS

(Source: Courtney, 2001, Fig. 4, p31)

The conventional approach to DSS would thus, move from problem recognition into problem analysis. However, Courtney's new decision-making paradigm does not move immediately from problem recognition into trying to 'model' the solutions, but to a process of developing multiple perspectives on the nature of the problem. Different tools and techniques can be used for this process. The mental modes determine what data and what perspectives we examine and how. These different perspectives can focus on different aspects or parts of a problem: Technical (T); Organisational and social (O); Personal and individual (P); ethical, and; aesthetics. This paradigm aims to:

"...recognize the connectedness of things in the universe, especially of complex social problems. The non-separability and irreducibility of elements in complex problems and issues is recognized. The development of multiple perspectives is the very core of UST. A critical aspect of developing multiple perspectives is open, honest, effective dialogue among all relevant stakeholders in the problem involved. Managers in such an environment must be careful to respect the rights and viewpoints

of the parties involved, and be open and honest themselves in order to gain the trust of those who will be affected by the decision” (Courtney, 2001 p.29).

Applying this multiple perspective approach requires the development of a cooperative environment – moving from viewing organisations as machines to viewing them as communities in which people learn from one another (Addleson, 2000 quoted in Courtney, 2002, p.35). According to Addleson five axioms for the development of a learning community are required:

- Foster collaborative relationship between people
 - Conviction and commitment of people to the community
 - People must be self motivated from ambitions, work ethic and responsibility to one another
 - Organisational boundaries are people’s boundaries with other people
 - Management is situational – conflicts and relationships need to be managed.
- (Addleson, 2000 quoted in Courtney, 2002, p.35)

This makes the use of conventional approaches to DSS decision-making inappropriate in terms of e-governance initiatives and more participatory approaches to policy implementation. Courtney’s new approach seems to offer a more feasible alternative. Part of this decision-making process and the perspective synthesis concerns the justification of decisions made or views taken. Toulmin et al.’s (1979) schema of reasoning can assist here.

4. A schema of reasoning

Toulmin et al. (1979) illustrate a technique which can be used to prepare individuals and groups of decision makers for the process of justifying a decision. They suggest the commencement of an initial process of ‘inoculation’ - exposure to justifying decisions which can assist in reducing this anticipation anxiety. They then identify six elements that can be found in any wholly explicit argument:

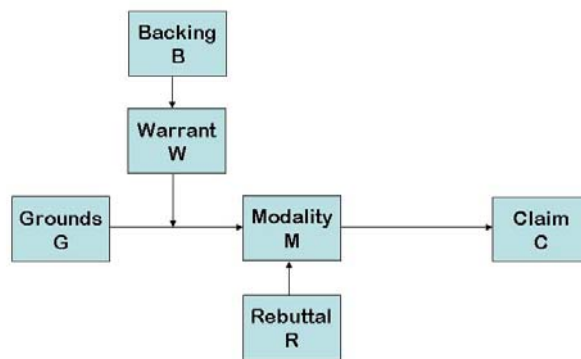
- Claims (What is the precise assertion being made?)
- Grounds (What is the foundation for making people believe the assertion?)
- Warrants (What guarantees or authorisation can be drawn upon to support the claim based on these grounds?)

- Backing (What general information can support this warrant?)
- Modal qualifications (What are the possible restrictions or limitations to the claim?)
- Possible rebuttals (What are the possible refutations that could be given to this claim based on this argument?)

The logical structure of the argument can be summarised as:

“Given grounds, G, we may appeal to warrant, W, (which rests on backing, B), to justify the claim that C – or, at any rate, the presumption (M) that C – in the absence of some specific rebuttal or disqualification (R)” (Toulmin et al., 1979, p.78).

This structure is illustrated by Toulmin et al (1979) in Figure Three.



*Figure Three: Logical structure of an argument
(Source: Toulmin et al, 1979, Fig 6-5, p.78)*

Toulmin et al’s (1979) justification for decisions and Courtney’s proposed approach to decision-making can be used to theoretically inform how the PAJA should be implemented. As discussed above, it is clear that the dissemination, understanding and implementation of the PAJA is far from ideal.

6. Discussion

In terms of the PAJA the conventional approach to DSS decision-making will not be useful in that government service delivery is complex. Paradigm shifts in the

philosophy of service delivery, a human rights approach to governance, and emphasis on participatory governance, especially at local level means that decisions are being made in a complex and changing environment which is fundamentally about social processes and fostering cooperative environments. Thus the implementation of PAJA must recognise that DSS can assist in some way, but only if they form part of a broader systems approach to its implementation. In terms of decisions impacting on society, as Phahlamohlaka and Roode (2001) note, conventional decision theory focuses on limited cognitive information processing capability of individual decision makers and not on the social aspects of the decision making process. In this sense Courtney's decision-making paradigm is a suitable paradigm in which to view the implementation of the PAJA. This also has implications on the decisions made are justified in such an organisational context.

In general, all arguments potentially need to be justified in some way, whether this is internally to oneself or externally to other parties. This can often cause anxiety (Phahlamohlaka and Roode, 2001) in the anticipation of the need to provide such a justification. Anxiety is heightened especially around decisions which are based on tacit knowledge, as it is often assumed that since the decision maker is accountable she/he can articulate the reasons for the decision. This may not be the case and so these expectations further increase anxiety (Phahlamohlaka and Roode, 2001, Beck, 1992, Giddens, 1991). Thus to assuage the similar errors caused by shrouded decision making typical of apartheid and to move towards a transparent approach to administrative decision making, this focus on the reasoning process is required for two reasons. Firstly, the constitution, which is the highest law in South Africa, mandates in Section 33 that all decisions taken by government must be lawful, reasonable and procedurally fair. Secondly, as discussed above in the PAJA any decision taken, or the lack of a decision, by Government that has a negative effect must be followed by written reasons if requested for. The process of reasoning and explanation can cause anxiety for government officials.

In terms of the decision making process there is little focus on the reasoning process that would need to be formed in terms of explaining the decision made either in the PAJA itself or in the guidelines on its implementation. Toulmin et al.'s (1979) schema could be used here. However, simply rewording the letter into the schema

and providing standardised responses would not be useful either. What would be required is training on developing this critical and systems thinking approach. Given that both the decisions made by the client and the administrator need to be justified to an external party Toulmin et al's (1979) schema could be useful here. However, the schema would also be of value in the process of deciding on alternative decisions which could be made if Courtney's new decision-making paradigm for DSS was used.

Therefore, given the changing environment and the ethical and social nature of the decisions covered by the PAJA Courtney's model (2001) looks attractive. Toulmin et al's (1979) schema of reasoning seems a more capacitating approach for the administrators than trying to develop the reasoning skills through sample letters. Such a schema of reasoning would commence once a problem is recognised (i.e. a decision which adversely affects the persons rights has been made), but rather than trying to 'model' the solutions Toulmin et al's (1979) schema could be used to develop multiple perspectives. In much the same way as Courtney (2001) suggests the use of cognitive maps, influence diagrams and entity-relationship diagrams Toulmin et al's (1979) schema of reasoning could be used to develop these perspectives. Figure Four summarises how the PAJA, the new decision-making paradigm and the schema of reasoning are interconnected.

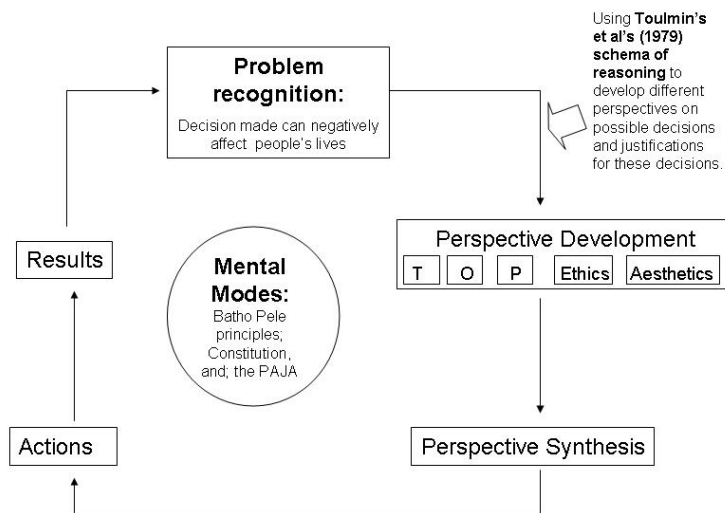


Figure Five: The PAJA, Courtney's new paradigm of decision-making and Toulmin et al's schema of reasoning.

7. Conclusion:

The PAJA addresses discursive action, where an agreement is needed to resolve a difference. However, for an inclusive and collaborative approach to service delivery as instantiated in the *Batho Pele* White Paper there should also be mutual/shared understanding and agreement on the solution. This goes beyond justifying a decision. In this case communication is the means of not just finding out what administrators have previously decided or learned, but a process in which opinion and consensus is created by the process of debate itself. To do this people must have the capacity and space/place to express themselves openly and freely and must accept the outcome of rational argument – requiring all communication in writing in a traditional orally based culture does not achieve this. For communicative action to occur, there is the need for a common understanding of terms, visions and cultural practices. Communication involves much more than the language used between actors, and incorporates a complex network of social relationships (Habermas, 1987). The process of communication will not remove all the barriers, but the attainment of critical reflection of individuals, through which emancipation can occur.

The underlying utopia is the emancipatory idea of a community of free and self-responsible citizens coming together and seeking to achieve consensus on matters of

public (non-private) concern by means of argumentative, oppression-free will-formation and democratic majority vote. (Ivanov, 1991, p.3)

Courtney's new paradigm on decision-making can be used to explore how the generation of multiple perspectives can foster the creation of the inclusive e-Governance or collaborative environment which we need to achieve if PAJA in particular, and Batho Pele in general, are to be implemented to lead to improved public service delivery.

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The successful adoption and usage of business intelligence in public sector organisations: an exploratory study in South Africa

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Abstract

Many success stories of adoption and usage of business intelligence tools in business organisations have been reported in the literature. Success stories have also been reported for public sector organisations, some of which are in African countries. It is generally claimed that successful adoption and usage of business intelligence tools leads to the provision of strategic information to decision makers and directly supports metrics-driven management. In this paper, a case study of successful business intelligence adoption and usage in a public sector organisation in South Africa is reported. Based on the results of the case study, the authors conclude that business intelligence tools can be successfully adopted and used in public sector organisations in Africa in order to improve individual and organisational performance. This in turn improves the level of service delivery to the target sector of the population.

Key words: ICT and Development, Business Intelligence, Task –technology fit, User satisfaction.

1. Introduction

Business Intelligence may be defined as a collection of technologies and applications that enable business organisations to collect, integrate, and analyse data about business operations in order to obtain information that is useful for decision making. Data warehousing technology, OLAP analysis, statistical tools for data mining, and timely information delivery via web technology form the core of business intelligence (Ponniah, 2001). Golfarelli et al (2004) further define business intelligence as a process that turns data into information and then knowledge. The knowledge is in terms of business performance, customer behaviour, the competition, conditions in the industry, and general economic, technological and cultural trends. Golfarelli et al (2004) further point out that over the past ten years, businesses have come to understand the importance of enforcing the achievement of business goals, as defined by the business strategy, through metric-driven management. Managers are therefore required to ensure that all business processes are effective by continually measuring their performance through Key Performance Indicators (KPIs) and balanced score cards (Kaplan & Norton 1992).

In the public sector, some organisations have come to realise the benefits of business intelligence and metrics-driven management. Some examples of these are in healthcare

(GOGNOS, 2007), education (Information Builders, 2005), social services for housing (COGNOS, 2003), and social services for poverty alleviation (ITWeb, 2005). While there is some academic/research literature on the adoption of business intelligence in the business sector, (eg. Information Builders, 2004; Golfarelli et al 2004), there is, unfortunately, very little literature on the subject as it applies to the public sector, especially in Africa. In relation to Golfarelli et al's (2004) observations on the benefits of business intelligence for the business organisation, one can deduce that, for public sector organisations, business intelligence can be used to turn data into information and knowledge. The knowledge is largely in terms of organisational performance. Managers in public organisations need to monitor the organisation's activities and formulate strategies that will result in the best service delivery possible for the target sector of the population. In the African context, such organisations work within many constraints, some of which are budgetary, while others are geographical.

Business intelligence has been shown to provide major benefits for the day-to-day running of business organisations. For example, Information Builders (2004) provides many examples where business intelligence has been applied at the operational level of business, to make a bottom-line difference. The central position of this paper is that business intelligence can be applied in public sector organisations in African countries to improve on the level of service delivery for the African citizen. The main research question that this research addresses, is: *What factors influence the successful adoption and usage of business intelligence tools for the support of decision making in public sector organisations?* This paper reports on the results of a pilot study that was conducted in the Western Cape provincial department of education. It is demonstrated that business intelligence tools can be successfully adopted and used in the public sector when the tools have a good fit with the day-to-day tasks of the planners and decision makers, and the tools are not easy to use. This leads to an improvement in individual as well as organisational performance, which in turn should lead to better service delivery. The rest of the paper is organised as follows. Section provides a brief description of the conceptual framework used for the research. Section 3 provides a background to the case study. The results of the pilot study are presented in section 4. Section 5 concludes the paper.

2. Theories on successful adoption and usage of Information Technology

The conceptual framework for this research is a combination of Task-Technology Fit (TTF) theory and user satisfaction theories, as employed by Kositanurit, Ngwenyama and Osei-Bryson (2006) in their study of ERP system usage. The Task-Technology Fit (TTF) model has been used by several researchers to study and explain how individual performance is influenced by the extent to which an Information Technology fits the characteristics of the tasks for which it is used by the individual (Goodhue & Thompson, 1995; Kositanurit et al, 2006). The main argument behind the TTF model is that when there is a good fit between the tasks performed by the user and the characteristics of the Information Technology (IT), then the utilisation of the IT, and the users' performance will be high. User satisfaction and performance studies focus on the conditions under which users are satisfied with the IT/IS they use (DeLone & McLean, 1992; Kositanurit et al, 2006). In their study of ERP system usage, Kositanurit et al (2006) combine TTF and user satisfaction theories to study and explain individual performance in an ERP

environment. They use the theoretical model shown in figure 1. This model was adopted for the research reported in this paper for purposes of studying and explaining why the usage of business intelligence tools has been successful in the public sector organisation that was studied.

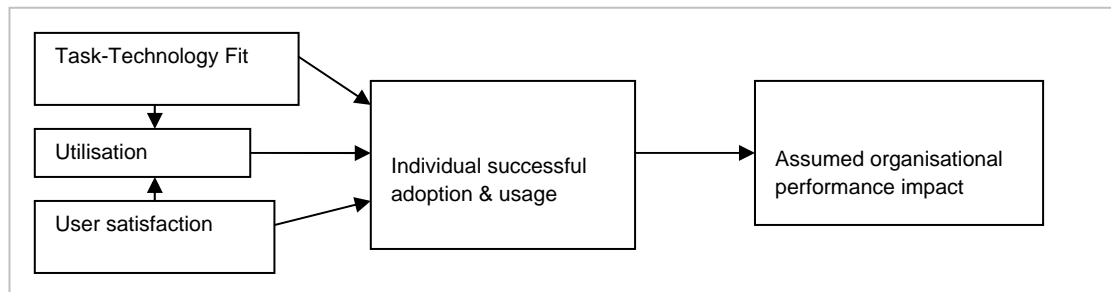


Figure 1: A model of TTF, User Satisfaction, individual and organisational performance impact. Adapted from by Kositanurit, Ngwenyama and Osei-Bryson (2006)

3. Background to the case study

There are many areas where public sector institutions can employ business intelligence tools. According to COGNOS (2003) areas such as defence, public safety and law enforcement, justice, education, health care, labour and human resources have successfully adopted business intelligence. In this section, a case study is reported, on education in South Africa. The case study has been chosen as good exemplar of typical problems/challenges that planners and decision makers in African countries are continually faced with.

3.1 Education Department of the Provincial Government of Western cape - South Africa

The Western Cape Province of South Africa has a population of 4 million people. The education department for the province (WCED) has a budget of approximately 5 billion rand (about US\$650 million) (Information Builders, 2005). The department supports a staff of approximately 29,000 educators and 8,000 support staff responsible for the schools throughout the province. There are more than 1 million students at more than 1,500 schools in the province. The department also coordinates and monitors adult education programs, early childhood development centres, and further education and training colleges. The main challenge faced by the department of education is how to prioritise the needs of the students and schools given their limited budget (ITWeb, 2005). The department needs to balance its role as an agent for social change with limited financial resources. Some of the questions they need to answer, and require management information about are (ITWeb, 2005).

- (1) How many and which schools do not have basic services such as sanitation, water and electricity?

- (2) How long will it take, and how easy/difficult is it, to provide these basic services?
- (3) How should teaching posts be allocated annually for each school in the province?
- (4) Which schools have unacceptably high student/teacher ratios?
- (5) The department is spending in excess of R100 million annually on learner transport. Is this spending effective?
- (6) Which schools and grades have unacceptably high dropout rates?

The district managers typically need a system that supports self-service reporting functionality so that they can quickly view and analyse information for each educational institution. The information needs of the Western Cape Education Department are managed by EMIS (Educational Management Information Systems) section, which is a subsection of the research division of the department. EMIS has acquired a suite of BI tools from two leading vendors, one for data warehousing and one for BI analysis and reporting. On an annual basis a variety of surveys are conducted. The data is captured and stored in an Oracle data warehouse/data mart. As a result of the BI implementation managers and other users with limited IT skills are able to conduct analysis, produce reports and deploy them to other members of the department via the web. This has resulted in improved communication and co-operation between various sections of the department and the creation of a common understanding of the problems/issues faced by the department. The department has also recently acquired GIS technology that is linked to the BI tools. This enables mapping and spatial analysis which should enable decision makers to identify factors (eg. rivers, mountains) that affect the provision of education in diverse geographical areas of the province.

4. Pilot study of BI usage in the WCED

A pilot is currently being conducted at the WCED in order to establish the factors that have led to the successful adoption of the BI tools they use to support their planning and decision making activities. Questionnaires were sent out to some of the personnel that use the tools on a regular basis. The questionnaire was based on the questions used by Kositanurit et al (2006). Table 1 provides a summary of the results that were obtained in the pilot study. The table shows the categories and sub-categories for the questions that were posed, as well as the descriptive analysis results for five responses that were received. The full list of questions is given in Appendix A. Appendix B provides the aggregated responses for each individual.

Table 1: Question categories, sub-categories and aggregated responses for the pilot study

Questions		Aggregated responses				
		Count of responses for the Likert scale levels for five (5) respondents				
Category	Sub-categories	L3	L4	L5	L6	L7
			Neither agree nor			

		Slightly Disagree	disagree	Slightly Agree	Moderately Agree	Strongly Agree
TTF	Functionality provided by the tool(s) is satisfactory		1	2	1	1
	Performance of the system / tool (s) is satisfactory					5
	Information content in BI reports is satisfactory			1	2	2
	Information in reports is accurate		1	1	3	
	Report format is satisfactory			2	2	1
	Reports can be obtained in a timely fashion			1	3	1
	Information in reports is up-to-date				2	3
	Level of detail for reports is satisfactory				2	3
	Aggregated score (average)				5	
	Technology fits the tasks					
User Satisfaction	Available meta data is satisfactory				4	1
	Learning how to use the system /tool (s) was easy					5
	The system / tool(s) is/are easy to use		1	1	1	2
	Quality of documentation is satisfactory	1	2		1	1
	Support provided by system administrators is satisfactory		2		1	2
	Aggregate score (average)			3	1	1
User is satisfied						
Utilisation	Aggregate score (average)					5
	I need to continue using the BI tools in order to work effectively					

For purposes of qualitative analysis, the questions were divided into the categories: TTF (Task-Technology-Fit), US (User Satisfaction) and UT (Utilisation). Each category was further subdivided into several sub-categories. Aggregate scores were computed as mean values for each category and sub-category and then projected onto the 7-point Likert scale for interpretation in terms of the descriptive levels of that scale. For the aggregates to be meaningful, all questions of the form '*X does / is not ..*' or '*I am not satisfied with Y*' were removed. From the aggregated responses, one can see that, for the TTF category all five (5) respondents moderately agree that the BI technology they are using fits the tasks they need to perform in order to make the decisions concerning educational services delivery to the various schools in the Western Cape. The aggregated responses for the US (User Satisfaction) category are more varied. One can however deduce that, all five (5) respondents agree that they are satisfied with the technology, with three (3) in slight agreement, one (1) in moderate agreement, and one (1) in strong agreement. For the UT (Utilisation) category, all five (5) respondents strongly agree that individually, they need to, and would like to continue using the BI technology in order to do their job effectively.

5. Conclusions and future work

It was pointed out in section 3, that the BI tools that are used in the WCED have enabled managers and other users to conduct analysis, produce reports and deploy them to other members of the department via the web in order to support decision making. This has resulted in improved communication and co-operation between various sections of the department and the creation of a common understanding of the problems and issues faced by the department. For the research reported in this paper, a combination of the TTF and User Satisfaction theories has been used in an attempt to explain the successful adoption and usage of BI technology in a public sector organisation in South Africa. The results obtained so far from the pilot study indicate that there is a possible correlation between TTF, User Satisfaction, tool utilisation and successful adoption and usage of BI tools in this organisation. Given that only five questionnaire responses were received for the pilot study, it was not possible to conduct a detailed statistical analysis of the factors that have influenced the technology adoption. In future, more questionnaire responses will be obtained and detailed interviews will be conducted in order to provide more accurate analysis results.

Acknowledgements

Acknowledgements are due to all the personnel in the WCED for making it possible for us to conduct the empirical research, and for taking off precious time to complete the questionnaires. Acknowledgements are also due to the personnel at STATOMET, Department of Statistics, University of Pretoria, for advice on the data analysis for the questionnaire responses.

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Appendix A: Questionnaire on TTF, User Satisfaction and Utilisation

TTF : Task-Technology-Fit, US: User Satisfaction, UT: Utilisation

No	Category	Su-category	Question
1	TTF	Currency	The reports provided by the BI tool are up-to-date for my purposes
3	TTF	Detail	The BI tool can provide me with information at an appropriate level of detail for my / my group's work
12	TTF	Content	The BI tool provides the precise information I need
13	TTF	Content	The information contents provided by the BI tool meet my needs
14	TTF	Content	The BI tool provides reports that seem to be exactly what I need

15	TTF	Content	The BI tool provides sufficient information for my needs
16	TTF	Accuracy	The system is accurate
17	TTF	Accuracy	I am satisfied with the accuracy of the system
18	TTF	Format	The information / reports are provided in a useful format
19	TTF	Format	The information in the reports is clear
20	TTF	Timeliness	The BI tool provides me the information I need in a timely manner
28	TTF	Functionality	The BI tool provides complete features I need
29	TTF	Functionality	I am satisfied with the speed of interacting with the system
30	TTF	Functionality	It is easy to detect possible errors in the BI reports / information I get from the system
32	TTF	Functionality	It is easy to correct errors that happen in the BI reports / information I get from the system
37	TTF	Performance	The BI tool helps me to be more effective
38	TTF	Performance	The BI tool has a positive impact on my productivity in my job
39	TTF	Performance	The BI tool is an important aid to me in the performance of my job.
4	US	Meta data	The exact meaning and source of the data used to produce the reports is easy to find out
9	US	Learning to use	It is /was easy to learn how to use the BI tool to obtain the reports/information that I need to do my work
21	US	Documentation	The content of the user manual / online help is useful
22	US	Documentation	It is easy to find information in the user manual / online help
23	US	Documentation	The user manual / online help is up-to-date
24	US	Documentation	The user manual / online help is complete
25	US	Documentation	The user manual / online help is easy to understand and follow
10	US	Usability	The BI tool I use is convenient and easy to use
26	US	Usability	The description of the functions/commands displayed on screen is clear to me
27	US	Usability	The function/command names of the BI tool are easy to remember
33	US	Support	I am satisfied with the amount of support provided by the vendor or other sources
34	US	Support	I am satisfied with the availability of information systems staff for consultation
35	UT	Utilization	Currently, I cannot accomplish my tasks without the reports / information from the BI tool
36	UT	Utilization	If I had a choice to use any systems to perform my tasks, I still would prefer to use the BI tool I currently use

Appendix B: Question categories, sub-categories and aggregated responses for the pilot study

Questions		Aggregated responses				
		Opinion (A – Agree, D – Disagree, N – Neutral) & Strength of opinion (Strong, Moderate, Slight) Based on the 7-point Likert scale				
Category	Sub-categories	Respondent no.1	Respondent no. 2	Respondent no. 3	Respondent no. 4	Respondent no. 5
General	Job description	<i>Admin clerk : Knowledge management</i>	<i>Administrator & team leader</i>	<i>Admin Assistant decision maker</i>	<i>Admin Assistant Monitoring schools</i>	<i>Decision maker Monitoring schools</i>
	Frequency of tool usage per day	<i>Multiple times</i>	<i>Multiple times</i>	<i>Multiple times</i>	<i>Multiple times</i>	<i>Multiple times</i>
TTF	Functionality provided by the tool(s) is satisfactory	<i>N</i>	<i>A Strong</i>	<i>A Moderate</i>	<i>A Slight</i>	<i>A Slight</i>
	Performance of the system / tool (s) is satisfactory	<i>A Strong</i>	<i>A Strong</i>	<i>A Strong</i>	<i>A Strong</i>	<i>A Strong</i>
	Information content in BI reports is satisfactory	<i>A Strong</i>	<i>A Strong</i>	<i>A Slight</i>	<i>A Moderate</i>	<i>A Moderate</i>
	Information in reports is accurate	<i>A Slight</i>	<i>A Moderate</i>	<i>D Moderate</i>	<i>N</i>	<i>A Moderate</i>
	Report format is satisfactory	<i>A Moderate</i>	<i>A Moderate</i>	<i>A Strong</i>	<i>A Slight</i>	<i>A Slight</i>
	Reports can be obtained in a timely fashion	<i>A Moderate</i>	<i>A Moderate</i>	<i>A Strong</i>	<i>A Slight</i>	<i>A Moderate</i>
	Information in reports is up-to-date	<i>A Strong</i>	<i>A Strong</i>	<i>A Strong</i>	<i>A Moderate</i>	<i>A Moderate</i>
	Level of detail for reports is satisfactory	<i>A Strong</i>	<i>A Strong</i>	<i>A Strong</i>	<i>A Moderate</i>	<i>A Moderate</i>
	Aggregated score	<i>A</i>	<i>A</i>	<i>A</i>	<i>A</i>	<i>A</i>

	(average) Technology fits the tasks	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>	<i>Moderate</i>
User Satisfaction	Available meta data is satisfactory	<i>A</i> <i>Moderate</i>	<i>A</i> <i>Moderate</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Moderate</i>	<i>A</i> <i>Moderate</i>
	Learning how to use the system /tool (s) was easy	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>
	The system / tool(s) is/are easy to use	<i>A</i> <i>Slight</i>	<i>N</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Moderate</i>
	Quality of documentation is satisfactory	<i>A</i> <i>Moderate</i>	<i>D</i> <i>Slight</i>	<i>A</i> <i>Strong</i>	<i>N</i>	<i>N</i>
	Support provided by system administrators is satisfactory	<i>A</i> <i>Moderate</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>N</i>	<i>N</i>
	Aggregate score (average) User is satisfied	<i>A</i> <i>Moderate</i>	<i>A</i> <i>Slight</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Slight</i>	<i>A</i> <i>Slight</i>
	Utilisation	Aggregate score (average) I need to continue using the BI tools in order to work effectively	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>	<i>A</i> <i>Strong</i>

M-Commerce in Developing Nations: Altering the Path To Economic Development And Wealth Creation

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Abstract

Although many definitions exist for mobile commerce (m-commerce), it is agreed that it encompasses all electronic transactions or information exchanges conducted via a mobile device and mobile networks (wireless or switched public network) that results in the transfer of goods or services or information of some value to the participants. So m-commerce is the intersection of e-commerce and mobile communications. With the explosive growth in mobile communications infrastructures in many developing nations over the last 15 years, mobile per capita usage has surpassed internet and computer access across many parts of Asia, Africa and South America. Faced with limited or non-existing fixed-line communications networks, rudimentary IT infrastructure, crumbling transportation networks, and inadequate financial resources, these nations seemed doomed to fall further and further behind, as the digital gap widens with the West. However, the appearance and growth of wireless network (by accident or by design) in many of these nations, with the flexibility and advanced technologies it offers, and the spectacular increase in mobile device usage that ensued, have led to the introduction of many new concepts and services and brought m-commerce to the remotest corners of the world. This has created a new dynamic that is altering the traditional path towards development and wealth creation, by creating the potential for countries and individuals that seize these new opportunities and leverage them, to leap-frog and fully join the 21st century information-based global economy and improve their lot. This paper will explore how m-commerce and the underlying Information Technologies are revolutionizing commerce, trade and wealth creation in many developing nations, and are poised to alter the economic equation for these nations. It will look at the opportunities and challenges facing the stakeholders in the m-commerce value-chain (consumers, government, service providers, and device manufacturers and distributors), the innovations, technologies, and ways in which m-commerce is becoming a potent economic development tool.

1. Economic conditions in Developing Countries

The term “developing nations” cover a vast spectrum of countries that range from the Least Developed Nations (LDCs) as defined by the Economic and Social Council of the UN (Haiti, Niger, Afghanistan, etc.) (ITU, 2007) to the emerging economies of Brazil, China, India, etc.

The GNI per capita (Gross National Income) goes from a low of \$700 for the LDCs to \$8,000 in emerging economies like Brazil (GVU, n.d.), still a mere fraction of the GNI of developed nations. Economic growth has been uneven across these nations. Most of the

developing countries have young, rapidly growing populations, with a large part of the population living below the poverty level or barely above it. Illiteracy rates are relatively high. The UNFPA estimate that 5.4 billions of the total world populations of 6.6 billions live in the less developed regions of the world (UNFPA, n.d.).

While the emerging economies like China, India and Brazil are seeing explosive economic growth, a significant number of developing nations are debt-laden and undergoing a variety of Structural Adjustment Programs, overseen by the IMF and the World Bank, and requiring among other measures, a restructuring of the public sector and privatizations of several segment of the economy (energy, telecommunications, banking, etc). Most of these nations have inadequate infrastructure in every critical sector (healthcare, transportation, education, energy) and their economic growth is barely keeping pace with their population growth and needs. The LDCs that are in the middle of, or just emerging from civil strife (East-Timor, Haiti, Liberia, DRC, Sudan, etc) have had most of their existing infrastructure destroyed. With huge needs for investment in every sector and limited means, developing nations are forced to carefully allocate their limited resources.

Apart from the emerging economies, most of the developing nations have a small, negligible industrial base. They import most of the finished goods they consume, tend to export agricultural and mineral products, and host corporations looking for cheap labor. The discovery of new oil fields in a number of poor nations (Equatorial Guinea, Chad, etc.) is creating new influx of capital but has not changed much of the economic conditions. Export tariffs, bilateral trade agreements, fluctuation in commodity prices and subsidies paid to farmers in developed nations are some of the trade barriers impacting the economies of many developing nations. There is increased political stability overall and various form of democracy in many of these nations; they are creating conditions to attract more foreign investments in sectors that have been privatized such as telecommunications, banking, hospitality, healthcare and energy-supply.

Internally, trade is flourishing. The informal sector has seen spectacular growth in many nations and has become the pillar of many economies in Sub-Sahara Africa and Asia, employing a large proportion of the working-age population. Regional economic blocs like ECOWAS (Economic Community Of West African States), MERCOSUR (Mercado Comun del Cono Sur) and ASEAN (Association of Southeast Asian Nations) have made regional integration and the flow of good and service within the regions easier, giving a noticeable boost to trade.

2. Communication infrastructures

Communications infrastructures (transportation, telecommunications, etc) play a critical role in the economic development of nations and the acquisition and distribution of wealth. The ability to move goods and provide services (physically or virtually), and the relatively free and timely flow of relevant information are crucial pre-conditions for any nation or individuals trying to compete in the new information-based economy of the 21st

century. Developing nations, for the most part, faced a daunting task in trying to meet these pre-conditions.

2.1 Transportation

A large number of the developing countries have difficult geographical characteristics (desert, jungles, mountain ranges, low population density) that make the cost of setting-up the needed infrastructure astronomical. Emerging economies like China and India are using their new-found wealth to build new airports and roads. With a limited number of paved roads and airports, and most rail-lines dating from the colonial era, economic activities come to a crawl during raining seasons in many nations in sub-Saharan Africa and the monsoon season in East Asia. The Democratic Republic of Congo (DRC), a country the size of all of Western Europe and a population of 65 millions, has less than 1,500 miles of paved roads in decent condition while France, a single country in Western Europe with a population of 63 millions, has more than 570,000 miles of paved roads (CIA, 2007b). Single lane roads and defective rail-lines that are the lifeline of many poor regions can be blocked for days by a single accident. Crops and agricultural products for exports are delayed or rot because of the lack of means to move it to the ports and markets; farmers and tradesmen can lose their whole working capital with a single such incident. Given the economic conditions described earlier, most governments cannot afford to subsidize them or bail them out so they go bankrupt. A vicious cycle of never ending poverty is perpetuated.

2.2 Telecommunications

In this new world economy, access to up-to-date telecommunications infrastructure is as crucial as capital and human resources in most sectors. The rise of the emerging economies of China, India, and Brazil is due, in part, to the information revolution and the underlying telecommunication infrastructure and technologies that made it possible.

2.2.1 Fixed-line

At the turn of the century, most developing nations were faced with a crumbling fixed-line phone infrastructure that was wholly inadequate for the most basic needs of most nations. The Republic of Benin, an LDC, with a population of 8 millions, had a six digit phone number, with 76,000 assigned and a telephone density of only 1 per 100 persons (CIA, 2007a). The RDC, with a population of 65 millions, had only 9,700 fixed -line phones in use (CIA 2007c). Far from being an exception, these statistics are typical of many developing nations. The wait-time for getting a fixed-line installed can be as long as 1 year in Benin. The cost of the installation was approximately \$200 for homes and \$400 for businesses. This is a very high cost when you consider that the Minimum wage for government employees is around \$50/month. With no street addresses in over 95% of the country and no home delivery of mail, the fixed-line phone company had to create its own internal address map for every town with telephone, and individuals have to line up for hours at the end of the month at the phone companies' offices to pay their bills (ITU, 2003).

2.2.2 PC-Internet

Internet usage and PC ownership are growing exponentially in the emerging economies of the world but have stagnated in many of the middle-and-lower tier developing nations after some initial growth in the late 1990s. According to the Internet world statistics organization, the internet penetration is barely 5% in Africa and between 12 and 21% in Asia, Middle East and Latin America, the areas where most of the developing nations are located (see figure 1). Moreover, PC ownership stands at less than 10 PC per 100 persons in these countries while nations like the US have an ownership rate of 75 PCs per 100 persons (Dittberner Report, 2007). Although programs like the *One Laptop per Child* project can help close some of the gap, at present, the PC ownership rate is not improving much.

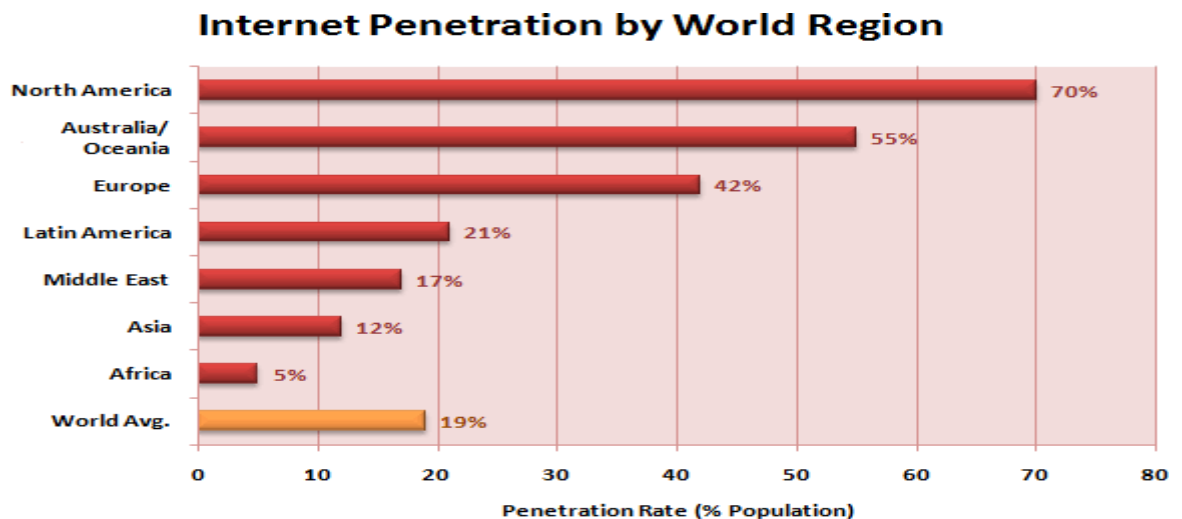


Figure 1: Internet Penetration by World Region (Source www.InternetWorldStats.com, 2007)

The advent of the internet and e-commerce was initially hailed as the means to close the global digital divide between developing and rich nations. This however failed to take into account some fundamental limitations faced by the poorer nations:

- the high cost of PCs (as a percentage of income)
- the need for IT literacy and overall low literacy rate
- the low availability of electricity
- the lack of high-speed access and difficulty in getting fixed-line phones
- the absence of relevant content on the internet for many developing nations' need

-the high cost of maintenance, upgrades and higher rate of failure of PC and server equipments in many hot and humid climate without air-conditioning.

Even the appearance of internet cafes and computer services at university campuses only improved the situation marginally. Most rural and less densely populated areas remain underserved and in the urban areas with internet cafes, few of the users are participating in e-commerce in any meaningful way. The majority lack credit cards, cannot afford the price of most products offered online, and they lack the knowledge and infrastructure necessary to sell their own products and services online. With the exceptions of the emerging economies, most of the developing nations have remained passive spectators in the e-commerce arena.

2.2.3 Mobile communications

The mobile communication sector has seen a spectacular growth all over the world, most noticeably in developing nations.

Infrastructure and technologies

While some nations (mainly in Asia) deliberately pursued a national wireless network policy as the most-cost effective way of building a 21st century communications infrastructure and closing the digital gap, mobile network appeared and grew in many developing nations as a side-effect of the privatization policy adopted to get World Bank and IMF loans and restructure their failing economies. Mobile communications infrastructures have rapidly grown and cover a substantial portion of most developing countries. These infrastructures, for the most part, are in the private sector and the operators are a blend of local entrepreneurs and western telecommunication giants with subsidiaries in these new markets; the fixed-line infrastructures and services remain, for the most part, in government hand.

Governments, in many parts, have opened the telecommunication market and encouraged competition, allowing multiple operators to cover the same areas. This has allowed coverage to extend to most rural areas as operators found themselves competing for every available customer and touting the reach of their network as a major selling point to subscribers. Mobile networks can be installed relatively quickly, are less expensive to build and offer better scalability when the customer base expands. With no need to maintain thousands of miles of wires and the ease of deploying antennas in difficult terrains at a fraction of the cost of putting new wires in place, mobile network have managed, in a few short years, to truly connect most regions of the developing nations.

A variety of technologies and services are in use throughout the multitude of mobile networks available in these nations. Although at the beginning, no specific standard was followed, nowadays, the majority of the wireless networks are GSM based. This was primarily driven by the handset manufacturers and the need for compatibility across networks. Most of the networks are primarily designed to carry voice and simple text messages. However, as demand increased and networks started competing for customers,

a few started introducing new technologies as a means of differentiating themselves from the pack, and also to attract high-end customers and businesses. Technologies like GPRS (General Packet Radio Service) and Enhanced Data Rates for GCSM Evolution (an add-on technology to increase data transmission rates and reliability) are being used by Safaricom, a wireless operator in Kenya. Many operators are using 2.5G and plan to introduce 3G with HSPA (High Speed Packet Access) wireless technology in the next few years. Most emerging economies have 3G technologies available in most urban areas already.

Coverage, market penetration and usage

Mobile phone subscribers have grown from around 10 millions in the early 1990s to over 700 millions by 2001 (Minges, 2001) and this rate shows no sign of slowing down. There are several billions of cell phones in use nowadays. In most of the developing nations, the number of cell phone users has already surpassed fixed-line subscribers. The DRC, with less than 10,000 fixed lines, has over 4.5 million cell-phones in use⁶. With the availability of pre-paid services, individuals who could never have had a fixed phone line (for lack of credit, a steady/formal job, a home address, etc) are now part of the customer base of the mobile phone operators. With penetration rates as high as 79% in South Africa, 73% in Tunisia (Griffiths, 2007) and similar numbers in many other developing countries, mobile communication is the dominant channel for communication and information flow in many of these countries. Uganda, a country where 85% of the population live in rural, remote areas, has managed to go from a phone coverage of less than 1% in 1995 (relying on fixed-line) to over 50% coverage for its population by 1999 (with 2 cell phone operators: Celtel and MTN Uganda) (Minges, 2001). The cell phone usage is further increased by the appearance of new informal businesses such as the “Umbrella peoples” in Lagos-Nigeria who make money by reselling airtime to passer-by, becoming a sort of “public pay-phone” service. The low cost of usage in countries like Cambodia where a basic service and a fixed set of minutes cost \$5/month has helped expand the footprint and usage of cell phones (Kem, 2004). Mobile communications usage has seen dramatic increases in countries like India and China and global telecom giants are emerging in these nations. China and India are now Nokia’s N°1 and N°2 cell phone market, surpassing the US and Japan. India alone has over 125 million subscribers with the number projected to increase drastically in coming years.

Issues and barriers

All the stakeholders in the mobile communications sector in developing countries faced a number of issues and barriers that make it hard for mobile communications to reach its full potential. Among these, the major ones are:

-The low purchasing power of the general public which makes the introduction of new, cutting-edge technologies a risky proposition for operators.

-The lack of national and regionally integrated telecommunications strategies and the over-reliance of Africa on satellite communications which is slower and costly compare to fiber.

-The lack of supporting infrastructure: reliable electricity, roads, and spare parts for telecommunication equipment

-The fragmented nature of the coverage offered to users, forcing individuals to have multiple cell phones to be able to reach all areas.

-The lack of roaming agreements between networks and the exorbitant cost where it exists

-The low level of investment in the network while demand is outstripping capacity.

-Bureaucratic red tapes and high tariffs on imports of electronic devices.

3. M-Commerce and its impact on development

m-commerce can be defined as any form of e-commerce or e-business conducted in a wireless environment. It encompasses all transactions and information exchange over mobile devices that have some intrinsic value to at least one of the parties to the transaction.

3.1 M-Commerce in developing nations

m-commerce is a new phenomena in developing countries, having come into being over the last few years, but has grown rapidly and is becoming one of the most visible aspect of the information revolution taking place around the globe. Initially, phone services were the only ones available and the cost up to the late 1990s, were exorbitant, limiting its availability to the rich and government officials in most developing nations. These services were mainly available around the major urban centers.

The explosive growth of wireless services in developing nations in the late 1990s was closely followed by the introduction of new services: SMS, Emails, Paging, m-banking, etc.

Although many m-commerce services are the same in developed and developing nations, some new services were specifically designed to address a pressing need in these developing nations, and many wireless service operators were forced to change their business models to adapt to their new operational environment. A few examples of m-commerce services in developing nations and the changes they forced on service operators are:

New distribution channels: because most individuals have no credit-history, no credit-card, no bank account, no Social Security Number and often no mailing address (a large portion of the developing nations in Africa and Asia remain without street addresses), the contract-based model for wireless services that is prevalent in developed nations proved impracticable; so new small retail businesses and distribution channels to sell mobile

phone card(30 minutes,60 minutes, etc) and allow remote activation have to be created to cover entire countries, from urban centers to the most remote village.

Multi-lingual services: Many subscribers use their cell phones for both domestic and international calls and don't necessarily speak English, French, Spanish, etc... Wireless operators had to staff calling centers to handle requests in a multitude of local languages.

Text messaging (SMS) and emailing are by far, the most popular uses of wireless services in many developing nations. Carriers had to devise mechanisms that can properly deduct usage while relying on per/minutes phone cards, and had to support SMS on domestic and international networks. In the Philippines for example, the wireless operator Globe Telecom, had 2.6 million users in 2000, of which 86% use pre-paid cards. These users were sending 25 million SMS per month across Globe's network. By creating a special rate for SMS, Globe was able to increase its SMS revenues 500% (Minges, 2001).

Air-time credit transfer: a new form of m-commerce was the Air-time credit transfer from one mobile phone to another. This allows individuals to trade small air-time on a given network after they have already loaded their time from the phone card. This created a small but lucrative business in remote areas where many people can ill-afford the \$10/30 minutes phone card charge, but can buy smaller chunks of time at rates of around \$2/5 minutes from resellers.

Mobile banking was also created in many nations (Mongolia, Kenya, etc) where access to traditional banks is difficult and vast distances have to be traveled to reach a bank office. Some mobile service providers created their own local banking services where users can open a bank account and then receive payments and transfer fund to other users from their wireless device.

A broader form of m-banking is the M-Tech model (see figure 2) where wireless service providers act as an intermediary between groups of buyers, sellers and banking institutions. For example, an association of farmers will use their wireless device to place an order for fertilizers with a seller hundreds of miles away. They will then send an authorization message to the service provider who can take money from their account at an affiliated bank and put it in escrow. The seller's bank is notified. Once the seller has received this notification, he/she will deliver the goods and the provider will authorize the release of the funds. The steps may be simpler for buyer and sellers that have ongoing relationships with the wireless service provider, but the main thing is that the wireless provider now offers its service as a trusted intermediary for the buyers, sellers and banking institutions.

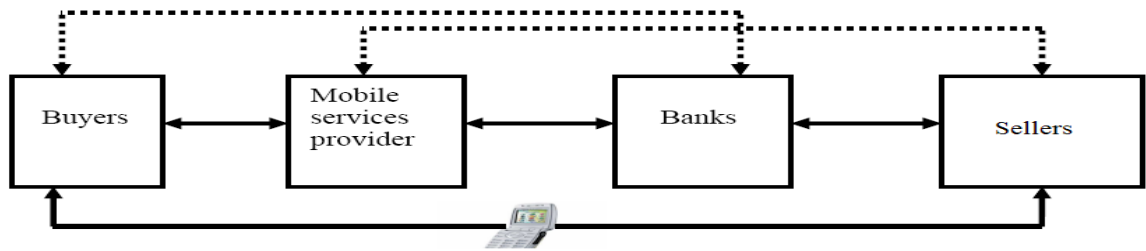


Figure 2: Simplified Model of M-Tech

Online information such as weather, sea currents and temperatures from reliable agencies, combined with a GPS locator, are made available, at a reasonable price, to fishermen in coastal areas, by wireless service providers. These fishermen, who cannot afford sophisticated radar equipment, now have access to up-to-date information on the best fishing grounds and are seeing increased revenue.

Mobile Devices: because of the low literacy rate and the low income level in many developing nations, device manufacturers who want to tap into this huge market have started redesigning their wireless devices and especially the GUI: Nokia, for example, created a cell phone specifically design for use in hot and humid weather that remains legible in bright sunlight, is long-lasting and uses images on its menu instead of letters and numbers that proved to be a low-profit margin but high volume item in South East Asia. (Bartlett et al. 2006)

3.2 Impact on economy and trade

The impact of the various m-Commerce activities are being felt in many areas in the developing nations: Information flow, internal/external trade, financial transaction, and job creation.

3.2.1 Change in Information flow and knowledge gap

Information flow is vital in any society and whoever has the means to get access to it, control it or limit its distribution can greatly influence events in the nation. For this reason, many governments have attempted to control information flow (primarily political information) through censorship, control of ISPs, monitoring of websites, etc. Mobile communications are providing a new means of avoiding this information control. The use of text message and other forms of mass distributions of information through wireless devices has proven very hard to control. Text messaging is credited with helping mobilize young people during the orange revolution in Kiev in 2004.

It is expected that China will be mobilizing an incredibly large number of cyber-cops during the 2008 Olympics to attempt to monitor the expected huge volume of wireless communications from cell-phones, black-berries, etc. The US government and Net freedom activists have started using text-messaging to send lists of proxy servers to cell phone numbers in authoritarian countries so individuals can anonymously send and receive information online and avoid detection (Bruce, 2007). There is easier access to

information for all segments of society, not just the elite and the educated, and this is having an effect on elections, policies and decision-making.

The change in information flow is not affecting just the political arena in developing countries. Many other segments: healthcare, agriculture, entertainment, etc are also getting impacted.

A farmer can take a snapshot of a new bug threatening its crops or a new fungus appearing on its plants and send it to the agricultural engineers and researchers hundreds of miles away, and get a quick call back with advice on the best way to deal with it. In the past, this farmer will have to wait till an engineer makes an inspection in the area to raise the problem, and by that time, the crop is most likely lost and the problem has spread. During the Ebola virus outbreak in Uganda in October 2000, the news spread quickly and information on precautionary steps were better disseminated to individuals and healthcare providers in all regions because of the excellent wireless coverage of the country. Individuals from dozens of African nations were able to vote and participate in “Big Brother Africa” using their cell phones.

3.2.2 Change in internal /external trade

Another area where information exchange and transactions taking place on wireless devices are making a big difference is in the internal and external trade arena. Having access to accurate information is the best way to negotiate a fair exchange, reduce cost and improve return on investments.

The impact of m-commerce on internal trade of developing nations:

In many developing countries, farmers, fishermen, cattle herders and craftsmen usually have access to limited information and depend almost completely on the very people they trade with to give them a sense of the market, prices, trends, etc. This leads to an imbalance of power during negotiations and allow traders to extract the maximum economic surplus from the trade with very little wealth going to the farmers, fishermen, etc. However, this has started changing with the advent of wireless communications and m-commerce.

Fishermen in India, equipped with a cell phone, now call or text message various ports to determine the level of demand and supply once they are done fishing, and can negotiate the highest price possible based on the demand. Moreover, since they don't have refrigerating equipments, if fishermen are running late, they can call and have a buyer wait for them so as not to lose the whole cargo when they get to port late. These services have greatly increased their bargaining power and transfer more wealth from middlemen to them. Some fishermen have seen their monthly profit triple since they gained access to these services (Sullivan, 2006).

With cell phone rates at 1 penny/minute in India, farmers are able to call around local markets to find the best price for their crop but also track price trends of specific crops in London and Chicago before deciding whether to sell locally or to large exporters. In emerging economies like China and India, real-time stock quote, news reports, sporting event results are also provided via wireless devices.

The impact of m-commerce on external trade of developing nations:

The availability of wireless devices and services has made the coordination with and access to partners and managers in developing countries by foreign companies a lot easier. Gone are the days where companies are out of touch with their local managers for days because a phone line is down or the manager has traveled outside the capital. With the wide availability of cell-phones, the USPS is now able to use Global express to ship to small African nations with no door-to-door mail delivery service such as Benin and Togo at a cost of about \$40. The postal services in those countries simply call or text the receiver when the packages arrive. This was impossible when only 5% of the population had access to landlines and no cell phones, and the only way to send a package Express was thru DHL at a cost of hundreds of dollars with the sender needing to find a way to notify the receiver that a package is arriving. These changes are allowing significant savings and causing an increase in shipping to those locations.

With better coordination and easy transfer of information from RFID tags to hand-held devices to servers at central locations around the globe, companies have started reducing the amount of inventory that need to be kept in stock in developing nations as less lead-time is now needed to ship needed supply to those locations. m-commerce has created an opportunity for small businesses with no web presence and no means of buying advertising on billboards and TV, to advertise their wares and services through text messaging, and also provide a way for people and other businesses(local or foreign based) to contact them.

3.2.3 Changes in the financial sector

Apart from the telecommunication sector itself, the financial services sector is the one that has being most impacted by m-commerce. Innovations in mobile banking, micro-payment and micro-finance have made mobile service providers full participants in the financial life of many countries and changed the way many businesses handle their financial transactions. At the same time, some financial institutions are entering the wireless service arena. In countries where very few people have credit cards, ATM are non-existent and internet transactions are minimal, m-commerce has revolutionize the act of buying and paying and has significantly increased the number and amount of transactions individuals do on a daily basis. Mobile banking has managed to provide the convenience of a credit/debit card and an ATM without all the cumbersome prerequisites and infrastructure.

Coca-cola, the largest distributor of soft drinks in the world, has started using mobile banking to save time and reduce incidents of hijacking of its trucks in several countries. With about \$2,000 worth of soft drinks for each truck-load sold in Zambia (a huge sum in Zambia- 10 millions kwacha), coca-cola drivers are tempting targets for thieves, and counting that much cash is time consuming. With mobile-banking, the whole transaction takes 30 seconds, the drivers send a text message, the money is transferred electronically and the driver is on its way with a receipt (The Economist, 2005). Coca cola avoids the need to keep significant liquidity on hand in these countries. This same process is used in many businesses: petrol stations where you can pay for your gas from your mobile phone, and even laundry services.

The Government of Zambia used Celpay, an m-banking service to pay more than 150,000 demobilized soldiers all over the country. Such an operation, if done the traditional way, will require moving truckloads of cash around the nation, several weeks of transactions and hours of travel time to various bank offices for the soldiers. A failure to quickly pay those soldiers could have led to civil unrest (Alini, 2007). In Mongolia, XacBank is planning to offer m-banking services to its clients across the country, eliminating the need for a half-day travel for livestock herders living far away from the bank offices. Similar services are offered in Nigeria, Philippines, etc. Wireless service provider, Safaricom, offers a person-to-person money transfer service called m-Pesa, which provides a cash storage account on the SIM card, and cash can be paid or collected from any of its agents and transferred to any cell phone in Kenya. Safaricom is partially owned by Vodafone.

3.2.4 New businesses/Jobs

Another area wireless services and m-commerce had an impact on development is the creation of new businesses and jobs. Celtel, one of the largest wireless service providers in sub-Saharan Africa has created over 8,000 point of sales jobs, 7,000 white-collar jobs and 170,000 jobs in supporting sectors (repairs, cell phone recycling, cell phone charge cards sales, etc) (Griffiths, 2007). Many jobs have been created in the informal sector (Air-time resellers, cell phone refurbishing, cell-phone unlocking) and an increase in the number of sellers of wireless devices has being observed in most developing nations. In order to increase the reach of their network for special events or areas that have limited coverage, Mobile van units are used by carriers like Areeba in Ghana. These vans carry a PH-phone system and other products like cell phone and pre-paid cards; customers can flag down the van to make a phone call and pay for the usage. This vans act like mobile pay-phones (Boadi and Shaik, 2006). A number of major wireless device manufacturers and some start-ups have set-up assembly factories and recycling centers in developing nations for the readily available cheap labor and closeness to their main markets. Sporting event results and general information services providers are appearing in many developing nations, using the m-commerce services available to provide weather, news reports, traffic reports and frequent updates of soccer matches to paying customers.

3.2.5 Future of M-Commerce in developing nations

M-commerce has yet to reach its full potential in many developing nations.

Potential

M-commerce has the potential of creating changes in several other areas and significantly impacting development and wealth creation in developing countries:

-While today, in countries like Benin, the water, electricity and fixed-line phone companies have to each maintain their own bill-delivery department (the post office does not deliver door-to-door) and customers line up for hours to pay the bill every month, an m-tech or mobile banking solution will allow these services to reduce their personnel cost and also save customers hours of wasted time.

-Government services, notorious for being slow and requiring several visits to get the most basic official documents, can set-up and allow appointments and queries by enhanced text message services.

-Services such as transportation schedule for trains and buses, health warning, wireless yellow and white pages, emergency services locator, accident report, etc are some other areas where m-commerce can have an impact on development.

-A study by Jensen (2006) has shown that the arbitrage that resulted from sardine fishermen in India having access to cell phone and getting accurate information to negotiate the best price for their catch has resulted in 8% increase in profits, 4% decrease in consumer prices and a 2% increase in per capita GDP.

-With more than a dozen countries with less than 5% wireless market penetration it is estimated that there is potential for 83 million new users in sub-Saharan Africa alone (Wireless Intelligence, 2007).

-Unlike many developed nations, mobile telephony is the only available means of communications in many countries so there are many more opportunities and more need to creatively use mobile communications devices to improve the daily life of citizens.

Limitations/Issues

m-commerce is limited by the current mobile communication infrastructure available in most developing nations. With limited bandwidth, 1G and 2G technologies, no coherent policies for introducing 3G across all networks, a fragmented market and uneven market penetration, incompatible networks and bureaucratic red tapes, m-commerce is limited in the range of services and the various sectors it can impact. Concerns about the security of private data (UNCTD, 2002) and the protection of bank accounts are also a major issue in m-banking. A public/private partnership will be needed at regional level to build fiber-optic backbones, provide reliable power sources, increase literacy rates and better regulate this sector and reduce the amount of red tapes that are stifling innovations. Licensing disputes can significantly disrupt business and daily life now that the

populations have come to rely on these services as was the case in the republic of Benin when the government suspended the licenses of some operators over a fee dispute and whole segments of the population and businesses lost their only means of communication.

4. Conclusion

With new technologies on the horizons and hand-held devices acquiring more and more computing power and content, m-commerce is poised to grow and change the face of many sectors of economic activities in developing countries. As businesses and governments grasp the potential for using m-commerce to reduce cost, improve delivery of services and the huge market it offers in developing nations, a more coherent and long-term strategy will be needed to really unleash the power of m-commerce. m-commerce is not a panacea for all the ills that plague many developing nations and will not miraculously turn them into a success story like Singapore or China. It however has the potential to pull a significant number of their citizens from below the poverty line and allow them to at least, partially participate in the new economy of the 21st century. Thus, it is important that we understand the issues that surrounds m-commerce development in IS practice and research.

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Information and Communication Technologies in the Republic of Malawi: an Assessment of Progress and Challenges Ahead

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ABSTRACT

Information and Communication Technologies (ICTs) have a major impact on western societies concerning economy, politics and culture. These technologies are a main driving force for societal progress and prosperity within such societies. But this development is still very limited and many regions of the world are cut off from the global information flow and have not yet arrived in the so-called information age. The paper at hand gives, based on the five dimensions of society (ecological, political, cultural, economical and technological), an assessment of progress and challenges the Republic of Malawi is facing concerning the implementation of ICTs. For this purpose, a case study in the Republic of Malawi was carried out, using expert interview surveys with Malawian decision-makers and questionnaires for the general public.

Introduction

“By the year 2020 Malawi, as a God fearing nation, will be secure, democratically mature, environmentally sustainable, self reliant with equal opportunities for and active participation by all, having social services, vibrant cultural and religious values and a technologically driven middle income economy.” (*Malawi Vision 2020: National Vision Statement*; taken from the *National ICT for Development (ICT4D) Policy, October, 2007; Draft Paper*)

In the last ten years an increasing body of literature dealing with the relationship between Information and Communication Technologies (ICTs) and development has been emerging (cf. e.g. Mansell/Wehn, 1998; Braga et al., 2000; Okpaku, 2003, Wilson, 2004). Especially for developing countries the challenges implicated with the so called information revolution are enormous and until today the question how developing countries should react to this remains open. In this paper, based on the findings from a study taken out in November 2007, an overview of progress and challenges concerning ICTs in the Republic of Malawi will be given. The research is guided by the question if and how ICTs are used in Malawi to foster societal development. Furthermore, the main barriers for the

country to enter the information age will be highlighted. Therefore, based on my understanding of sustainable development, which is grounded on ecological, political, cultural, economical and technological sustainability, current development projects, which are supported by ICTs will be analysed.

ICTs for Development

If one reviews the current literature on ICTs for Development it is getting clear that two central viewpoints are in the focus of the discussion: on the one hand the opportunities are highlighted, whereas on the other hand the risks are dominant. Braga et al. for example state for developing countries that “[...] the challenges are substantial. The possibility that the gap already existing between the front-runners of the networking revolution (mostly high-income economies) and those lagging behind (mostly low-income countries) may still grow larger, raises the spectre of a ‘digital divide’. The concern here is not restricted to the issue of connectivity per se; it also includes the implications of connectivity (or lack of it) for economic growth and the broader agenda of sustainable development. The danger faced by all is that digital divide may reinforce patterns of divergence both internationally and within countries” (Braga et al., 2000: 1). The authors also stress the “digital opportunities”, which go side by side with the challenges for developing countries, when they point out that developing countries “[...] can scientifically benefit from investments in modern information infrastructure in a pro-competitive regulatory environment, and leapfrog stages of development in terms of networking roll-out” (Braga et al., 2000: 1-2). This neoliberal understanding is purely focused on economic benefit resulting out of competition.

The idea behind it is that economic development based on free, deregulated markets will automatically lead to societal progress and wealth for all. The developing countries should adopt the Western economic system, monitored by institutions such as the World Bank, which includes large privatisation activities. Of course this modernization theoretical approach is criticised by a number of scholars. For example Ngwenyama et al. conclude that “[...] decades of the IMF and World Bank’s austere policies and the more recent privatization programs on the health, education and civil infrastructure have had a devastating impact on many developing countries” (Ngwenyama et al., 2006: 7).

By the adoption of the Western capitalist’s system a lot of pressure is put on developing countries to join international institutions and agreements. A crucial issue in this context for example is the question of intellectual property rights. The World Intellectual Property Organization (WIPO) is a UN agency with a mandate to harmonise intellectual property rights across the member states. Recently WIPO has developed a plan to harmonise patents, which has tremendous consequences for developing countries. Carlos Correa in his critiques summarises: “[...] harmonized standards would leave little room for developing countries to adapt their patent laws to local conditions and needs; harmonization would take place at the highest level of protection (based on standards currently applied by developed countries, especially the United States and Western European

countries) meaning that the process will exert an upward force on national laws and policies in developing countries resulting in stronger and more expansive rights of the patent holders with the corresponding narrowing of limitations and exceptions. Such higher standards are unlikely to have a positive effect on local innovation in developing countries; and also the danger that the current draft contains standards that are primarily aimed at benefiting the ‘international industries’ and not individual inventors or small and medium size enterprises. (Correa, 2004: 9) It is becoming clear that economic development is in the focus of the debate. Following the understanding of sustainable development argued in this paper, such a reductionistic approach includes several shortcomings and therefore the following working definition of sustainable development is proposed:

Sustainable societal development satisfies the needs of current and future generations; a sustainable society is a society that is based on ecological sustainability (e.g. ecological conservation, stability in the area of health), political sustainability (e.g. political participation, peace), cultural sustainability (e.g. stability in the area of education, self-determined life-styles), economic sustainability (e.g. material wealth) and technological sustainability (e.g. usability and wise use) (cf. Fuchs/Blachfellner/Bichler 2007: 304). The question, which emerges is, how ICTs can be used to enhance the sustainability of all five subsystems to ensure societal well-being.

Already in 1998 Robin Mansell and Uta Wehn have introduced an alternative approach in their book *Knowledge Societies. Information Technology for Sustainable Development*. The focus here lays on ICT applications that could assist developing countries to reap the “[...] social and economic benefits associated with extremely rapid innovation in advanced ICT-based goods and services“ (Mansell/Wehn 1998: 82). The authors discuss a number of ICT applications, which they consider to be appropriate to enhance a broader understanding of sustainability. This list of applications includes e-government, e-learning, e-travelling, e-transport, e-health, e-education and e-inclusion. Christian Fuchs is right when he argues: “These are technologies that today are mainly developed in Western countries and benefit the latter.” (Fuchs, 2006: 49) But still, the attempt to broaden the discussion and the formulation of concrete areas of applications points into the right direction. Following the proposed working definition, I contend in this paper that a sustainable society is based on ecological, political, cultural, economical and technological sustainability. Thus ICTs should be used in a way that fosters the sustainable development in each dimension. In Figure 1 promising strategies for the sustainable use of ICTs are assigned to the five dimension of sustainability (cf. Bichler, 2007: 352).

Figure 1: ICTs for Sustainable Development

Dimension	Strategy for ICT use
Economic Dimension	<ul style="list-style-type: none"> - Wealth for all through new job opportunities - Open Source products instead of Intellectual Property Right patents - Open access to Internet services and applications instead of restrictions (e.g. unpayability, blocking of websites)
Political Dimension	e-government services in form of involvement of citizens through participation instead of purely providing information
Cultural Dimension	<ul style="list-style-type: none"> - ICT awareness through education: well directed ICT training programs instead of self-undirected learning by doing - e-learning applications as a chance to bring education to rural areas
Ecological Dimension	Using cognitive and communicative features of ICTs to rise the awareness of ecological conservation and health related issues
Technological Dimension	Improved usability: the design of applications, which are easy to use and appropriate to the region

Methodology

The study combines quantitative and qualitative methods. The primary data were drawn from a survey of users in eight Internet cafés in the two major Malawian cities Lilongwe and Blantyre in November 2007. Lilongwe is the administrative capital whereas Blantyre functions as the unofficial economic capital. Internet cafés were chosen because the Internet penetration in Malawi is only 0.4% of the total population⁵ and therefore Internet cafés seemed to be the ideal place to find out about the Internet habits of those who actually use the Internet. The Internet cafés e-Center, Licom - Lilongwe Communications, Under the Tree, MGI Cyber Café, Mohiwa Investement Telekom Café, Icon Cyber Center, Informatix and Malawi Net, as well as the respondents, were chosen randomly distributed over the two cities. Usually the Internet cafés were not very well equipped, providing neither headsets nor web cams. After an introduction of my research project, the Internet café managers agreed on my intention to distribute the questionnaires to the clients. I personally handed out the questionnaires and in total 270 completed ones were given back to me.

⁵ Source: internetworldstats.com, 2008

Similar to a study taken out by Peter G. Mwesige⁶ in Ugandan Internet cafés the questionnaire contained both, open- and closed questions that were tested in a small pre-test study at the ICT&S Center of the University of Salzburg. Besides using the questionnaires to find out about quantitative aspect, they were also used in a qualitative way, focusing on different forms of Internet use. The quantitative analysis was carried out with SPSS.

In addition expert-interviews with Malawian decision-makers from governmental institutions, universities, business companies and NGOs were carried out to gain a broader picture.

To round the research off, four Internet café managers were interviewed to discuss their views of the Internet in Malawi. These interviews were very fruitful to gain a deeper understanding about the Internet situation in Malawi, especially concerning the usage.

The researcher also acted as a client in the selected Internet cafés. This enabled different observations concerning the cafés' equipment and the nature of the clients. The combinations of all these research techniques facilitated the researcher to gain a comprehensive understanding of the ICT situation in Malawi, especially regarding the Internet.

Republic of Malawi: Socio-Political Context

Following the *CIA World Factbook* (2007) in July 2007 the Republic of Malawi had estimated 13.603.181 inhabitants. The median age was 16.7 years and the population growth rate for 2007 was expected to be 2.38%. Landlocked Malawi is one of the poorest countries in Southern Africa and belongs to the so-called Least Developed Countries (LDCs). *The Economic and Social Council of the United Nations* uses three criteria, which a country must satisfy, for the identification of LDCs:

- “a low-income criterion, based on a three-year average estimate of the gross national income (GNI) per capita (under \$750 for inclusion, above \$900 for graduation);
- a human resource weakness criterion, involving a composite Human Assets Index (HAI) based on indicators of: (a) nutrition; (b) health; (c) education; and (d) adult literacy; and
- an economic vulnerability criterion, involving a composite Economic Vulnerability Index (EVI) based on indicators of: (a) the instability of agricultural production; (b) the instability of exports of goods and services; (c) the economic importance of non-traditional activities (share of manufacturing and modern services in GDP); (d) merchandise export concentration; and (e) the handicap of economic smallness (as

⁶ Mwesige, Peter G. (2004): Cyber elites: a survey of Internet Café users in Uganda. In: *Telematics and Informatics*, 21, 83-101.

measured through the population in logarithm); and the percentage of population displaced by natural disasters.” (UNO, 2002-2005: online)

Until the independency in 1964 Malawi was the British protectorate of Nyasaland. 30 years of one-party rule under President Hastings Kamuzu Banda followed, which led to international isolation. The first free elections that brought Elson Bakili Muluzi into power were held in 1994. Current President Bingu wa Mutharika was elected in 2004 and started an anticorruption campaign as well as a financial discipline program in 2005. In 2006, Malawi was assimilated under the Heavily Indebted Poor Countries (HIPC) program. Currently the Malawian government faces many challenges, above all the rapidly growing problem of HIV/AIDS. Other crucial issues include developing a market economy, improving educational facilities, as well as facing up to environmental problems (deforestation, land degradation, water pollution from agricultural runoff, sewage, siltation of spawning grounds endangers fish populations) (cf. CIA World Factbook, 2007: online).

For 2004 it was estimated that 53% of the population lived below the poverty line. Like in other developing countries, access to educational institutions is very limited. In Malawi the literacy rate, which can be understood as a precondition for ICT use, is at 62.7% along with a for developing countries obligatory gender divide. Whereas 76.1% of the male population can read and write, 50.2% of the female population is illiterate (cf. CIA World Factbook, 2007: online).

Malawi's Telecommunications Landscape: History and Present

In 1993 the first Internet connection for an e-mail service was established in Malawi. A visibility study was taken out by the UNDP⁷ in 1995 to assess the potential of ISPs⁸ in the country. The results indicated that the market existed, however an ISP was not established due to licensing issues. Back then Malawi did not have a telecommunication regulator, which was concerned with ISP licensing issues and instead of licensing the UNDP supported *Malawi Sustainable Development Network Programme (SDNP)*, the private company *Malawi Net* was licensed in 1997 (Nyirenda, 2007; Personal Interview). Under the *Malawi Communications Act* from 1998 the *Malawi Communications Regulatory Authority (MACRA)* was established “with responsibilities for licensing telecommunications, postal and broadcasting operators, settling disputes among operators, approving tariffs, promoting and monitoring free and fair competition, allocating and managing the radio frequency spectrum, managing the numbering plan, type approving terminal equipment and protecting the consumers” (www.macra.org.mw). Following this telecommunications act in 1998 a second ISP (SDNP) was introduced. The infrastructure was built up with the help of the UNDP and the service was funded for two years. Since 2000 SDNP is self-sustaining and is furthermore self-responsible for the development of their infrastructure.

⁷ United Nations Development Programme

⁸ Internet Service Provider

Today there are 10 active commercial Internet Service Providers in Malawi out of the licensed 22 ISPs, offering a wide range of Internet services. The total number of users in 2006 was 55.029; by given 13 millions inhabitants the Internet penetration is only at 0.4 in Malawi (cf. MACRA, 2007). For 2007 the *CIA World Factbook* numbers 347 Internet hosts in use. According to Paulos B Nyirenda, head of SDNP and Professor at the University of Malawi, the growth rate, after a high increase at the beginning of the millennium, has been flattening since 2006 due to the high costs of Internet connection and computers. In 2007 Malawi had 175.209 main telephone lines subscribers (fixed line penetration: 1.35) and with a number of 944.503 nearly six times more mobile cellular phones (cf. MACRA, 2007).

ICTs and Development: Technological Dimension

The connectivity issue is an enormous barrier for the diffusion of ICTs in Malawi. The results of my survey suggests that for 57% of the respondents the slow connection, for 15% the availability of computers and for another 12% the non-existence of an Internet connection were the major problems. Since the country is not connected with a fibre cable, all Internet access is based on satellite Internet services. This makes the Internet connection on the one hand very expensive and on the other hand extremely slow.

Under these circumstances much is expected from the NEPAD⁹ initiative. Malawi is a signatory to the NEPAD Protocol on the *ICT Broadband Infrastructure Network*, which is dedicated to developing both submarine and terrestrial broadband networks across African countries to ensure that there are cheap and high-quality communication services. Under this initiative it is planned to connect Malawi to Mozambique and Zimbabwe via fibre cables. The one to Mozambique is scheduled to function already in 2009. This would mean a tremendous step for Malawi because Mozambique is again connected to South Africa and from South Africa there is one fibre cable to Europe and another one to India. Another intention is to build a fibre cable infrastructure, which connects Malawi to Dar es Salaam and Lusaka. In addition the *Malawi Telecommunications Limited (MTL)* is running a separate fibre cable program. Together with the Mozambican telecommunication provider *Telecomunicações de Moçambique (TDM)*, MTL is planning to connect the two countries by June 2008. MTL furthermore aims to expand the infrastructure inside the country by setting up a fibre backbone interlinking Blantyre, Lilongwe, Zomba and Mzuzu (Machika, 2007; Personal Interview).

All these efforts are associated with the hope that the data-signalling rate will increase and the costs will go down. But Paulos B Nyirenda is not so optimistic: "In West Africa the fibre is already there, but the price is still around 3000 Dollars per megabit/s per month. It has to do with the companies that build the fibre and

⁹ New Partnership for Africa's Development

the amount of return they get for their investment. Fibre connections are big business, not controlled by the government” (Nyirenda, 2007; Personal Interview). Like in other African countries, the government does not any longer control the IT infrastructure sector. Companies from outside, mainly from the Western world, are building the infrastructure. In the case of Malawi, Alcatel-Lucent is charged by the Malawian government to establish the connection to Mozambique. (Nyirenda, 2007; Personal Interview). As Yunusa Z. Ya’u (2005) in his article *Globalisation, ICTs, and the New Imperialism: Perspectives on Africa in the Global Electronic Village* so aptly sums it up: “While African countries that have undertaken the liberalisation of the telecommunication sector have ended state monopolies they have suddenly found themselves saddled with a new monopoly: that of the foreign investors. The AITEC report on the state of ICT infrastructure in Africa for the year 2000 (Hamilton 2002) clearly shows this trend.” Western companies mainly drive the implementation of the telecommunication infrastructure. The shareholders of *Malawi Net* for example are *US Comnet* with 64% and *MTL* with 36%. *Celtel*, the main mobile phone provider, belongs to *Zain* (formerly *MTC*), an international corporate group based in Kuwait. *Celtel* has built networks in 15 African countries and covers more than a third of the population of Africa.

Mobile phones have become widespread phenomena in the last five years, almost exclusively in form of prepaid services. Currently there are two providers, *Celtel Malawi Limited* licensed in 1999 and *Telekom Networks Malawi Limited* licensed in 1995. The high mobile density (6.53) compared to the very low fixed line penetration (1.35) could potentially support the leapfrogging thesis, which states that developing countries can overleap certain stages of development by using mobile technologies (cf. Castells et al., 2006: 216). Nyirenda (2007) basically agrees on that, especially since *Celtel* started a GPRS¹⁰ service in October 2007, but mentions at the same that it heavily depends on the price since mobile airtime is three times more expensive than the already very expensive fixed line costs.

ICTs and Development: Economic Dimension

It is getting clear that the technological difficulties strongly affect the economic subsystem. Due to the missing infrastructure a dial-up connection with 33 kbit/s for example costs about 30 US Dollar per month, whereas a faster WiMAX¹¹ connection with 64 kbit/s starts around 200 US Dollar per month. Additionally one has to pay between 70 and 100 US Dollar to the *Malawi Telecommunications Limited (MTL)* for the telephone line; that makes the line costs about three times more expensive than the service costs (Nyirenda, 2007; Personal Interview). Taking into account that for 2006 the GNI per capita¹² was calculated to be 170 US Dollar¹³ it becomes obvious that the majority of the population is financially

¹⁰ GPRS (General Packet Radio Service) is a mobile data transmission technology available to users of GSM (Global System for Mobile Communications)

¹¹ Worldwide Interoperability for Microwave Access

¹² Gross National Income per capita

¹³ Data taken from the World Bank:

excluded from Internet use. Nyirenda states that the monthly price for a satellite connection in Malawi, this applies for Southern Africa in general, is 3000 US Dollar per megabit/s. Under this heavy economic pressure the market cannot afford to offer broadband solutions (Nyirenda, 2007; Personal Interview).

At the moment there are hardly any people profiting economically from ICTs in Malawi. Those who do profit from these technologies are already the elite of the country and the majority of the people are facing the risk that the already existing gap is even going to widen. Eighteen percent of the respondents in my survey had a net income between 300 and 500 US Dollar and astonishing 21% had an income higher than 500 US Dollar. Taking into account that the GNI per capita is about 170 US Dollar it is obvious that Internet use is limited to very pecunious people and the majority is economically excluded. My findings concerning the age distribution show that the very high costs also lead to problematic user demographics: the typical Internet user in Malawi is already quite old. Most of the respondents, forty-nine percent, were between twenty-six and forty years old.

These findings refer back to the very high costs. Nyirenda also agrees on that by stating that older people mainly use the Internet for business purposes, because using the Internet for fun is far too expensive for youngsters (Nyirenda, 2007; Personal Interview). Bearing in mind that the median age was just 16.7 years and 46% of the overall population is aged under fourteen years (cf. CIA World Factbook, 2007: online), it seems essential to enhance the number of young people using the Internet. In that case the problem is not an educational one since only seven percent noted the lack of skills as a main problem concerning Internet use. This low number may arise from the quite high diffusion of IT relevant subjects in private schools and universities, where 54% of the survey participants learned their computer skills and 37% their Internet skills. The biggest barrier is the cost factor, which 59% of the interviewees asserted as the central difficulty. 57% of the participants in the survey mentioned that they used Internet for business purposes, mainly to communicate via E-Mail. Another result of the high expenses is that only 34% of the respondents had Internet access at their workplace and therefore it is quite common to leave the office to use the Internet in Internet cafés.

As aforementioned the mobile penetration is already quite high in Malawi and it seem that the Malawian government has already realised the potentials offered by mobile phones. At the moment the *Ministry of Agriculture* is running a project named *Farmers and Corps*, which aims to support Malawian farmers in their sales activities. Like in other African countries, the farmers make use of the quite well established mobile phone infrastructure by accessing economic information via mobile phones. The market prices for certain commodities, such as tomatoes or maize, can be found out on a daily basis by using SMS¹⁴. Experiences from other

<http://devdata.worldbank.org/external/CPProfile.asp?CCODE=MWI&PTYPE=CP>
¹⁴ Short Message Service

countries, such as Ghana or Kenya, demonstrate that this application can make a substantial contribution to the economic development and therefore this is a promising project.

ICTs and Development: Ecological Dimension

At the moment there are no specific e-health or ecological awareness raising applications available in Malawi. The conducted study however shows that the Malawian Internet users already apply the Internet for searching health related issues by using e.g. *Google* to find out how to treat certain diseases. Nineteen percent of the respondents stated that they use the Internet to seek health information for themselves or others. Especially Malawi, where a lack of doctors is ubiquitous, could benefit from e-health applications by introducing information focused applications as well as interactive communication tools. Given that the awareness of the possibilities already exists on the user side, focusing on e-health services is a crucial issue. The prime hindrance again is the connectivity problem, because interactive telemedicine applications require a high bandwidth. Currently, the Malawian telecommunications infrastructure is not really capable to accomplish such services.

ICTs and Development: Cultural Dimension

At present the Malawian government is carrying out a project called *Universal Access Policy for rural Telecommunications Development*, which aims at connecting underserved communities in remote areas. For this purpose three central strategies are applied: The first one focuses on the establishment of Telecenters, which offer telephony, Internet access and photocopy services. The government does not maintain the Telecenters, instead local entrepreneurs should run them. The idea behind is that “[...] it should be like a business for them” (Machika, 2007; Personal Interview) and thereby it should be self-sustaining when the government pulls out.

The second strategy deals with capacity building. Most of the Internet content is produced outside Malawi, mainly in the Western world, and therefore it is quite often not relevant for those people living in rural areas. This is also shown by the findings from my research, which demonstrates that *Google*, *Yahoo* and *Hotmail* are predominant. There is hardly any content in the main language Chichewa, thus this strategy targets at the production of local content, which is appropriate for the people and the region.

The third strategy tries to intervene on the hardware aspect. Devices such as computers or mobile phones are still very expensive and therefore the government is beholden to help reducing the costs. The distribution should take place from community to individual ownership and is funded by the *Universal Access Grant* (Machika, 2007; Personal Interview).

Besides health related applications my findings suggests that e-learning services would be well received by the Malawian Internet users. The category *Research*

for School and/or University counted for 48% and the category *Training and Educational Purposes* for 30% of the respondents as a main purpose for Internet use. At the moment there are no specific e-learning or distance learning applications and thus the Malawians use mainly search engines (e.g. *Google*) to get learning materials. The great interest in education and health related issues might serve as a good departure point for the implementation of ICTs for sustainable development.

ICTs and Development: Political Dimension

The findings of my survey illustrate that e-government is still in the early stages. Only thirteen percent of the interviewees conducted administrative procedures online, twelve percent caught up on political activities via the Internet and fewer than two percent use the Internet to co-ordinate political activities. This has again to do with the bad connectivity, because most of these services are highly interactive and hence require a stable and fast data-signalling rate.

Presently there are two projects in the range of politics: the *National ICT for Development (ICT4D) Policy*, which is aimed at catalysing the socio-economic development using ICTs and the *Government-wide Area Network Project*, which endeavours to link countrywide all governmental offices within one network. The *Department of Information Systems and Technology Management Services* is carrying out this internal project to enhance the information flow between all governmental institutions with the goal to foster effectiveness and to reduce costs. The ICT4D Policy focuses on (cf. National ICT for Development Policy: Draft Paper):

- 1) **Strategic ICT Leadership**
- 2) **Human Capital** with the sub-themes *Education, Health and Accelerated Human Resource Development*
- 3) **Governance** with the sub-themes *Promoting Electronic Government and Electronic Governance, Promoting ICT Security and Promoting National Security, Law and Order*
- 4) **ICT Industries** with the sub-themes *Facilitating the Development of the Private Sector and Developing an Export-Oriented ICT Industry*
- 5) **Promotion of ICT Infrastructure**
- 6) **Growth Sectors** with the sub-themes *Modernization of the Agriculture, Promoting E-Tourism and Modernization of the Natural Resources,*
- 7) **Community**
- 8) **The Legal and Regulatory Framework**
- 9) **Regional and International Cooperation**

The Malawian government has chosen a multi-stakeholders approach to implement the ICT4D Policy, including governmental institutions, the private sector and non-governmental institutions. Although the policy points into the right direction, covering all areas proposed in this paper, the outlined strategies remain very vague and the presentation of concrete projects is missing. Furthermore the financing of the proposed strategies remains open.

Conclusion

The analysis shows that currently there are different ICT related projects in all five proposed dimensions (ecological, political, cultural, economical and technological) of sustainable development. The success of all these projects heavily depends on the technical infrastructure and in the case of Malawi technical difficulties are the main barrier for the diffusion of ICTs, especially the Internet. The fact that the country is not yet connected with a fibre cable leads to very high costs combined with an extremely low bandwidth and this again results in the exclusion of the majority of the Malawian citizens.

Generally the low number of users (55.029 in the year 2006) and the limited availability of services resulting from the poor infrastructure remain immense challenges for the political decision-makers. The expansion of the infrastructure is a central concern of the *National ICT for Development Policy*, but the question how to realise this remains unanswered. The same applies for the rest of the mentioned strategies.

Anyhow, the already existing projects discussed in this paper are promising and the great interest of the Malawian Internet users in education and health related issues opens up the possibility for the adoption of new Internet based services in form of e-learning and e-health applications. The results of the survey indicate that such services would be well received by the Malawian users and thus would contribute to a sustainable use of ICTs.

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New and appropriate methods of evaluating ICT-based projects in Africa: NORAD project on ICT development for Makerere University

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Abstract

This paper discusses the function of Monitoring and Evaluation (M&E) of projects. It starts by describing what M&E is all about and what it is supposed to do and describes some of the methods that are commonly used. Several references are made to James and Miller (www.infodev.org) from where a good amount of literature about the study is provided. James and Miller (www.infodev.org) mention and describe the appropriate ways in which the M&E function should always be conducted that include the need to have a good understanding of the goals and objectives of the program, the need not to conduct the M&E function in isolation, the need to involve all the stakeholders, the need to determine any risks that can be in the project, the need to structure the M&E function such that the implementers do not look at it as a policing function, the need to integrate the function in the project right from the start and the need to conduct the function in a participatory atmosphere. Finally the paper discusses how an M&E based on Logical Framework is being applied in a project to enhance the use of ICT in teaching and research currently being conducted in Makerere University, the main public university in Uganda. This study shows how the Logical Framework can be used not only to indicate progress of the various activities but most significantly to derive the benefits being achieved from the various activities.

Introduction

Evaluation refers to the activity of reviewing information collected on a project so that progress can be checked against some set goals. It focuses on the achievement of the project's purpose and goals within a given period. For most projects evaluation usually goes hand in hand with monitoring. Monitoring involves gathering of information about a project during the time of execution. Hence as a way of determining and assessing the progress of a project people usually do an activity of M&E. According to James and Miller (www.infodev.org), M&E essentially is a function which allows ongoing learning and feedback throughout the design, planning and implementation of a project. It includes the assessment of results at the end of the period as related to the original objectives. So basically it is concerned with both the efficiency and effectiveness of project implementation, and assesses how efficiently inputs are translated into outputs.

How to conduct an M&E function

James and Miller (www.infodev.org) mention that there are a number of things that must be looked at right from the start of a project. They say that " understanding where you are going is the only way to get there, and one has to include defining the overall goals and objectives, understanding of the context for the study, identifying key players, and selecting from different approaches of carrying out M&E". This essentially means that if the goals and objectives of a project are not clear and well spelt

out then no valuable results can be achieved from a project. Lack of a clear goal and objectives of a project can be equated to lack of a building plan for a new proposed building.

James and Miller(www.infodev.org) mention and discuss the fact that no project can take place in isolation. They say that it is important to understand the influences of existing national and local policies and strategies, plus the political and administrative structures that can affect implementation. They add that “any information that can be gathered prior to the start of an M&E activity, such as baseline data, previous studies, reports, proposals and project plans would provide a better basis for understanding what a project or program is set out to achieve”. What James and Miller are trying to put forward here is that the nature of activities that are carried out in a project are usually impacted upon by the environment within which a project is carried out.

James and Miller (www.infodev.org) further say that it is important to give some thought to whether there are any risks associated with successful implementation of the M&E. For example; will key players (stakeholders and implementers) cooperate, will there be difficulties in collecting data? It is important to note that in quite a number of instances, key players in ICT projects fail to put in their full commitment to the projects. This must be attributed to the natural phenomenon of people’s resistance to change and fear of new technologies.

James and Miller (www.infodev.org) also mention that program implementers sometimes regard M&E as an externally driven and imposed ‘policing’ action with little perceived value. In other words some people fail to own their projects to the extent that they even just take M&E as a function that is simply policing them. They further mention that basically M&E seems to be like a technical exercise, designed for and used by technical experts and researcher, whereas the ultimate purpose of the exercise should be to provide useful information for decision makers.

As remedy to this problem James and Miller (www.infodev.org) say that recent trends have been moving more towards a participative, learning approach with improved local ownership of M&E efforts and greater collaboration between policy makers, implementers and learners.

Other issues that hinder people from actively doing the M&E function include the fear of the possible high costs that may be involved and also being ignorant of the direct benefits that can be achieved.

James and Miller (www.infodev.org) say that it is not only complex to estimate the costs of engaging in M&E, but the benefits are also difficult to estimate in financial terms. They give the following as the recommended facts:

1. The M&E process should be an integral component of any planned ICT project. It should be factored into planning before the project starts, and should be included at all stages.
2. Appropriate, realistic and measurable indicators should be selected to monitor outputs and outcomes. The data collected should be relevant and there must be a clear understanding of what is to be done with it once it is collected. In order to achieve this, effort should be put in to ensure that all monitoring, evaluation and assessment instruments are carefully pilot tested. (Unwin and Day www.infodev.org).
3. All major stakeholders should be identified and involved in making M&E decisions. This helps to avoid possible problems in the process.
4. Adequate thought must be given to who the key target groups are supposed to be in the implementation, and what expected outcomes are desired for each group.

5. M&E should not aim at imposing a punitive management structure that seeks to use this function as a way of negatively criticizing performance.
6. Sound M&E frameworks and practices should always be put in place at the inception stage of an implementation program, rather than as an afterthought once implementation is well underway.
7. The M&E framework should be fully aligned with the program design or research methodology, drawing on both quantitative and qualitative data.

If these facts are adhered to, the M&E function then becomes a project output in its own right, with the added benefits of learning from past experience. And so the outputs from a well-designed M&E plan can in turn influence the future directions that the project can take and allow levels of flexibility and adaptability to changing circumstances.

James and Miller (www.infodev.org) also point out that, evaluation should look at performance against goals. The evaluation activity should take place while the project is underway, and should be concerned with evaluating how the intervention is meeting its performance goals. At the end of the project then there should be an evaluation of how effective the program was in as far as meeting its original objectives. This is called summative evaluation.

In summary several issues emerge from the issues raised by James and Miller. First of all, the goals and objectives of a project must be very clearly spelt out to give proper direction of the project and to indicate clearly what the deliverables of the project are meant to be. The environment and most especially issues to do with cultural values and political/administrative policies also have a great influence to the implementation process. Stakeholder cooperation is another important factor that project implementers have to be cautious about. Lack of cooperation by the stakeholders can greatly jeopardize the intentions of the project. Some project implementers fail to own the M&E function and instead look at it as a policing function. One of the remedies to these is to institute a participative approach between policy makers, implementers and learners.

Various M&E Methods

1. Logical Framework Analysis

A Logical framework also called log frame is a tool for planning and managing development projects (www.gdrc.org). It summarizes the following in a standard format (www.gdrc.org):

- What a project is going to achieve
- What activities would be carried out to achieve its outputs and purpose
- What resources (inputs) are required
- What the potential problems which can affect the success of the project are
- How the progress and ultimate success of the project is to be measured and verified

Bill Jackson on (www.iucn.org) says that the logical framework approach provides a set of designing, implementing and evaluating projects. He mentions that the purpose of the LFA is to undertake participatory, objectives-oriented planning that spans the life or policy work to build stakeholder team commitment and capacity with a series of workshops. Workshops can

be scheduled through the life of the project to encourage brainstorming, strategizing, information gathering, and consensus building among stakeholders. In other words the LFA provides in-depth analysis of the project objectives, outputs and activities.

Some of the downsides of Logical Frameworks

One of the main criticisms about the LFA approach as provided on www.gdrc.org is that it begins by identifying problems which poses the following problems:

1. Generating of poor results because the initial negative focus pervades the rest of the LFA process. This often results in limited vision of potential solutions.
2. Beginning with the problem analysis can be particularly a serious problem in cultures that consider it inappropriate to openly discuss problems or criticize.
3. LFAs are often developed after the project has been designed rather than used as a basis for design. The use of the LFA late in the design process can often be attributed to:
 - A lack of understanding of the LFA approach
 - The fact that LFA is seen as a requirement of funding agencies and not a design or management tool.
4. LFAs do not readily enable monitoring unintended consequences
5. LFAs are rarely considered by project managers to be a key planning tool.

2. Rapid Appraisal Methods (RAM).

These are quick, low-cost ways to gather the views and feedback of beneficiaries and other stakeholders, in order to respond to decision-makers' needs for information. Bergeron (1999) says that RAM generally involve low costs; are highly adaptable to different situations; and tend to facilitate establishment of rapport with communities thus allowing to bring out qualitative aspects that would be missed out by close-ended surveys. On the other hand Bergeron (1999) says that RAM has disadvantages that include poor generalizability of findings, lack clear validation procedures and susceptibility to manipulations by informants.

3. Participatory Methods.

These methods provide active involvement in decision-making for those with a stake in a project, program, or strategy and generate a sense of ownership in the M&E results recommendation. Glenn(1994) says that participation can involve a group in one location meeting face-to-face, or geographically dispersed but connected by telecommunications. The down side of this method is that it requires gathering people together which at times may not be easy.

4. Public Expenditure Tracking Surveys (PETS)

PETS track the flow of public funds and determine the extent to which resources actually reach the target groups. They examine the manner, quantity, and timing of releases of resources to different levels of government, particularly to the units responsible for the delivery of social services such as health and education. They can be used for diagnosing problems in service delivery, and providing evidence on delays, 'leakage' and corruption. According to www PETS is designed to provide crucial information that can help policy makers in either policy formulation or reformatory activities by identifying gaps in allocation and disbursement of funds to the intended recipients.

Case Study Description

Makerere University is currently running a project sponsored by a Norwegian funding agency to enhance the use of ICT in teaching and research. The project is to go up to the year 2010 and has various activities that include:

1. Establishing local area networks (LANs) and procurement of 400 computers for 5 faculties
2. Procurement of web based modules to enhance an already existing university information system by opening up access for users not ordinarily registered on the system.
3. Procurement and installation of a central database server and centralized backup system
4. Procurement of servers for Disaster Recovery
5. Installation of fire-fighting equipment for server farm
6. Development of intranet portal and associated applications to provide the university community with a single access point at all university online information and data services
7. Implementation of IP telephony infrastructure to provide campus wide voice services

The M&E method that was selected for this project is the Logical Framework. This was the method chosen because first, it was one of the methods that the project coordinators were most familiar with.

Secondly the LFA was considered to be quite appropriate for analyzing this kind of project which has distinct activities. According to AusGuideline (2005) the logical framework can help planners and managers to do the following:

- Analyze the existing situation during activity preparations
- Establish a logical hierarchy of means by which objectives can be reached
- Identify the potential risks to achieving the objectives, and sustainable outcomes
- Establish how outputs and outcomes might best be monitored and evaluated
- Monitor and review activities during implementation

The frames that were developed are shown in the appendix.

Description of the Log Frame

Considering the components as indicated above, the first task that was required when constructing the LFA was to determine:

1. What the objectives are
2. What the activities are
3. What the outputs are
4. What the outcomes are
5. What the indicators are
6. What the methods of verification are

The LFA in the appendix clearly shows what is constituted under each of these attributes.

For example:

- Activities 3, 4 and 5 all are to address the objective namely: ***To increase reliability of ICT services to the university community.*** This is based on the following:

1. Activity 3 is concerned with procurement and installation of a central database server. With a centralized database all data should be stored in one central place therefore ensuring high integrity is kept high.
 2. Activity 4 is concerned with procurement of a centralized backup system and servers for Disaster Recovery. A disaster recovery centre is a good a fall back position for continuity of processes thus providing increased reliability.
 3. Activity 5 is concerned with Installation of fire fighting equipment. This kind of equipment being in place also provides increased protection and thus increased reliability.
- Activities 1, 2 and 6 5 all are to address the objective namely: ***To increase access to ICT services to staff and students.*** This is based on the following:
 1. Activity 1 is for establishing local area networks and procurement of computers. All these are for providing increased access to the central computer resources.
 2. Activity 2 is concerned with procurement of web based modules, and this is for providing a wider access to the university main information systems.
 3. Activity 6 is concerned with development of intranet portal and associated applications to provide a single access point to all university online information and data services. This is to provide increased efficiency when accessing the various resources.
 - For activity 7 is to address the objective namely: ***To improve intra-university voice communication using in-expensive technologies.*** This is because this activity is concerned with installing a telephone voice service over the campus wide data network infrastructure.

A summary of progress of the activities was as follows by the time of writing this paper:

No	Activity	Current status and achievements
1	Establishing LANs and procurement of 400 computers for 5 faculties	Fully delivered but impact is yet to be assessed because the delivery was quite recent (during this year)
2	Procurement of web based modules	A vendor contracted but no delivery yet.
3	Procurement and installation of a central database server a centralized backup system	Fully delivered but impact not yet assessed because the delivery was quite recent (during this year)
4	Procurement of and servers for Disaster Recovery	Procurement process is still on –going
	Installation of fire-fighting equipment for server farm	Procurement process is still on –going
5	Development of intranet portal and associated applications to provide the university community with a single access point.	Design work is still on-going
6	Implementation of IP telephony infrastructure to provide campus wide voice services	Design work is still on-going

Overall assessment of the progress for the case study:

To-date only activities 1 and 3 are completed. Item 3 which is for the installation of the centralized database server and backup system has produced a marked increase in the data storage space. For the rest the items, the procurements are still on-going and there are delays due to various logistical reasons. For example the procurements for the items 4, 5 and 6 are being done for the first time and the items involve a lot of new technologies. Therefore is a lot of research that has to be done first before deciding on what to procure. The biggest problem is that there is a set timeline within which the project must be end beyond which funds shall no longer be available. The best approach should have been to have clear specifications of what each activity requires before the project begins. Alternatively at least items whose specifications are not clear should never have been included in the project.

Another issue is that activity number 2 for instance involves the procurement of some web based modules to increase the accessibility of the existing information systems. Since these modules are for increasing the accessibility of the information systems, they can only be supplied by the original supplier of the information systems. This has brought about a situation whereby the university has to rely on only one supplier for this activity which compromises the procurement regulations. Situations which can make people get stuck with only one type of supplier should as much as possible be avoided.

Conclusion and Recommendation

This paper has described M&E and has illustrated its significance in ICT project management. It has been observed that for better results the M&E function must be integrated in the project design right from the start of the project and all stakeholders must be involved in the activities at all stages. Also situations which can drive the stakeholders to feel that the M&E function is policing them must always be avoided. It has also been observed that there are many methods of M&E available and that the choice of the method to use for a particular project must depend on nature of the project and the kind of evaluation that is being carried out.

A case study has been describes and one of the important point that has been stated is that in order to avoid un necessary delays during the execution period of a project, it is important to have a good understanding of the requirements before the commencement. In other words people should always not wait for funds and then start planning. Plans must always be kept made and if necessary kept aside so that when funds become available the execution just goes ahead without any interruptions.

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Appendix

Log Frame for ICT Development Project

ICT DEVELOPMENT

OBJECTIVE	ACTIVITIES	OUTPUTS	OUTCOMES	INDICATORS	MOV
To increase reliability of ICT services to the university community	<p>Procure and install equipment for a centralized database server</p> <p>Procure and install equipment for a central data storage and disaster recovery</p> <p>Procurement of a fire suppression system for the server rooms</p>	<p>Centralized database server</p> <p>Equipment for data Storage plus four servers</p> <p>A fire suppression system</p>	High availability (efficient & effective) of ICT Services	98% service uptime	Service Monitoring reports
To increase access to ICT services to staff and students	<p>Set up computer labs in five faculties</p> <p>Procure and set up web based modules to provide increased access to the existing information systems.</p> <p>Staff training</p> <p>Produce and disseminate information about the systems</p>	<p>Computers labs with a total of 400 computers</p> <p>A web interface for students and staff access</p> <p>5 workshops</p> <p>User guides for students and staff</p>	Increased use of existing information systems	98% increase in user Traffic to existing Information Systems	<p>Server Logs</p> <p>System generated reports</p>

OBJECTIVE	ACTIVITIES	OUTPUTS	OUTCOMES	INDICATORS	MOV
	Implement a single sign-on system	An intranet portal			
To improve intra-university voice communication using in-expensive technologies	Procurement and set up of VoIP equipment Sensitization of students and staff	12 servers for VoIP system 90 office SIP phones Information Brochures	Reduced per-unit call telephone expenditure across the university Increased intra-university voice communication among staff and students. Increased access to different devices for voice communication among members of the university community	Cost per call volume. Annual no. of voice traffic per person Ratio of other voice communication devices to fixed phones. (Increased)	Telephone Bills Server Logs/statistics Public phone call statistics Inventory of connected telephone lines Inventory of other connected devices

**Gender on the “ICT Research for African Development” Agenda:
Learning with GRACE**
(Gender Research in Africa into ICTs for Empowerment)

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Abstract

The focus and commitment to create bridges between the world of African women and the world of policymakers necessitated the generation of context-specific data that would make women’s agency visible and make the rationality of their choices understandable. The GRACE project comprising of 14 sub projects conducting independent research in 12 different African countries found that women’s agency is contingent on the one hand on the forces of the global market economy failing Africa in numerous ways and on the other hand on the gendered social and cultural norms prevailing within Africa’s patriarchal societies. Yet within these confinements women’s agency did shine through and revealed that at the four various stages discerned at women’s journeys towards empowerment through the use of ICTs, women would immediately share with their direct environments any gain they would reap. This finding is coherent with general predictions that women’s empowerment is one of the major mediators for social and economic change. It is therefore recommended to step up the efforts to support and enhance women’s access to and use of ICTS, making sure however that women are the agents of their own development and change processes.

Introduction

ICT policy is currently being made and implemented all over the continent. Unfortunately this is happening mostly in the absence of clear knowledge about the ways gender inequality and ICTs are impacting on each other. Men’s and women’s attitudes, needs, lived realities and perspectives on ICTs are likely to differ (Rathgeber: 18). Gender “neutral” policies tend to favour men because of their implicit and unexamined male-centric focus (Hafkin 2000; Hafkin and Taggart 2001).

While it can be argued that, especially in this time of increasing poverty and the challenge of HIV/AIDS, Africa faces more serious development problems than women’s lack of ICT use and participation in the Information Society, Africa’s history of development interventions would caution us to take such a stance. The 1970s model of modernization grounded in a euro-centric concept of the gender relations within a household, negated women’s economic responsibilities and contributions and thus entrenched patriarchal relations and exacerbated the economic disparity between the sexes (Nzegwu 2002).

The deterioration of women's access to resources resulted in deterioration of the economic situation of households, leading to malnutrition of children and other vulnerable members of society. The link between women's agency and well being on the one hand and child survival rates on the other hand has been extensively documented (Sen 1999). Furthermore, women's agency has a direct bearing, not only on women's well being, but also on general development, as it impacts positively on fertility rates (ibid.). "The changing agency of women is one of the major mediators of economic and social change and its determination as well as its consequences closely relate to many of the central features of the development process" (ibid. 202).

However, according to anecdotal evidence and to a more limited extent, statistical evidence, the gender digital divide is growing in the developing world in general and especially in Africa (Hafkin & Huyer 2006). Furthermore, as ICTs are merely tools which in and of themselves are not empowering they can also be used to strengthen existing gender imbalances and be used in ways that disempower women. As in the 1970s model, policymakers and researchers in the ICT field currently find themselves in a similar situation of having to enter an arena of development which, in the absence of a gender analysis, has generated already complex unintended effects and may even generate more and different ones. Policymakers and development agencies may now, just as then, have similar blind (gender) spots. By becoming alert to a gender dimension in ICT developments at a fairly early stage of the information revolution, we may be able to prevent greater scaled undesirable effects in the future.

Because ICTs enable governments and development agencies to deliver their services more effectively and efficiently, ICTs can become very important tools in general development and poverty eradication efforts. They therefore deserve serious attention to prevent them from being unintended and unintentional instruments of women's disempowerment and from broadening and deepening the gender digital divide (UNESCO 2003).

Amartya Sen states "nothing, arguably, is as important today in the political economy of development as an adequate recognition of political, economic and social participation and leadership of women. Yet at the same time, he admits that the "extensive reach of women's agency is one of the more neglected areas of development studies, and most urgently in need of correction" (Sen 1999: 203).

Research is therefore needed to bring more clarity in the way women exert their agency in relation to the use of ICTs in the context of development and to influence policy from that perspective. Insight is needed into the ways women relate to ICTs (if at all), how gender issues hinder or enhance women's access to and use of ICTs, how they have accomplished their dreams in relation to ICT use, what they needed in order to get there,

what obstacles they faced and how they managed to overcome their internal and external barriers.

The conceptualization of GRACE: Gender Research in Africa into ICTs for Empowerment

Based on the considerations outlined above, GRACE (Gender Research in Africa into ICTs for Empowerment) was conceptualised and realised (Buskens, Esterhuysen and Radloff 2004; www.grace-network.net). GRACE was envisioned by the International Development Research Centre (IDRC) and the Association for Progressive Communication (APC). It is funded by IDRC and managed and developed by Research For the Future (RFF).

GRACE has the following objectives:

- The formation of a research network that can do ongoing gender and ICT research in Africa.
- The formation of research expertise in various institutions throughout Africa that can contribute to the debates around gender and ICT issues.
- The generation of knowledge that will influence policy at local, national and regional/global levels.

GRACE comprises the following projects:

Women Entrepreneurs in Nairobi: Questioning the power of the cell phone; *Alice Wanjira Munyua, Kenya*

The specific objectives are to: 1) identify use of cell phones in these business activities, 2) investigate how the use of cell phones has changed the way of doing business, and 3) identify challenges and barriers to their use.

Our Journey to Empowerment: The role of ICTs; *Ruth Meena and Mary Rusimbi, Tanzania*

Through sharing their stories, women articulate some of the factors, which have provided them with opportunities or constraints in accessing and controlling ICTs. The objective is to explore the extent to which the women involved have been able to transform their socio-economic positions in their society.

The Mobile Telephone as a tool for Promotion of Emancipation and Strengthening of the Entrepreneurial Initiatives of Women Fish Processors and Wholesalers in Dakar; *Ibou Sane and Mamadou Balla Traore, Senegal*

The research analyses the role of mobile phones in the economic activities of Senegalese businesswomen, considering economic, social, cultural and historical factors.

The Mobile Village Phone Business: A vehicle for rural women's Empowerment and gender equality in Uganda; Grace Bantebya Kyomuhendo, Uganda

The research explores in depth how eight women engaged in the village phone business have changed their lives through this business and to what degree they can and cannot overcome certain gender induced socio-cultural barriers towards structural empowerment.

The Use of the Internet by of Women Entrepreneurs in the Textile Sector of Douala; Gisele Yitamben and Elise Tchinda, Cameroon

Speaking with women international traders who access the Internet, the research is exploring the impact of this access on their business practices.

Women's Use of Cell Phones to Meet their Communication Needs – a study of rural women from northern Nigeria; Kazanka Comfort and team, Nigeria

Given the strategic roles women in rural communities play in the survival of their families, their use of a cost effective means of communication, such as mobile phones, is being given detailed attention in this study.

Egyptian Women and ICTs: A formula for empowerment; Leila Hassanin, Egypt

The research explores how women artisans and traders are using

ICTs to improve their livelihoods and the spaces they are creating in doing so.

Digital Empowerment and the Fight Against Gender-based Violence; Amina Tafnout and Aatifa Timjerdine, Morocco

The project examines the existing ICT infrastructure in the legal centres, analyses how women and the centres have access to and use the ICTs, and will recommend areas for improvement to help their work of addressing violence against women in Morocco.

Where are the female students in the ICT labs? Reflections on the lived realities faced by female post graduates students at the University of Zimbabwe; Buhle Mbambo-Thata, Elisabeth Mlambo, Precious Mwatsiya, Zimbabwe

The research focuses on the female students who do not make use of the computer labs (the majority) as well as the female students (a small minority) who do make use of these labs and attempts to determine the factors that influence both types of behavior.

Women's use of ICTs in Manhica and Sussendenga: A tool for empowerment? Gertrudes Macueve, Judite Mandlate, Lucia Ginger, Polly Gaster and Esselina Macome, Mozambique

This research is seeking to verify the ways in which ICT access and use is or is not providing tools that enable poor women (directly or indirectly) to make advances towards economic and social empowerment.

ICTs as an Agent of Change: A case for grassroots women entrepreneurs in Uganda; Dorothy Okello, Angela Nakafeero and Susan Bakesha, Uganda

The project assesses the factors that have facilitated women's access to the information provided, examines how rural women entrepreneurs have used the information, and will generate ideas on the best ways to provide the information they require.

Mobile Cellular Phones for Zambian Women: Making Life Better? *Kiss Abrahams, Zambia*

The purpose is to identify the ways that women use cell phones to counter or overcome gender discrimination, and to gain more control within economic and gender relations.

Women's Empowerment, Engagement and Satisfaction in ICT Careers in Kenya: Breaking the stereotyping and discrimination in ICT environments; *Okwach Abagi, Olive Sifuna, Salome Omamo, Kenya*

The major questions being asked are how ICT career women have been empowered, and what have their experiences and challenges been – how have they been able to address the challenges in the world of work as ICT women professionals?

Reflecting on GRACE: South Africa participatory research process on Energy, ICTs and Gender; *Jocelyn Muller, South Africa*

Women living in rural communities articulate the ways that they envisage (off-grid) energy and particular ICTs contributing towards an improvement in their livelihoods.

On the basis of the totality of these research questions, a general research question was formulated to form a “container” for them all: “How do women in Africa use ICTs for empowerment?”

The GRACE Approach

The approach within GRACE was characterised by the following elements:

The general methodological direction was qualitative in nature focusing on the perspective of the women respondents as ICT users;

The GRACE researchers conducted their projects in their own communities operating as native anthropologists;

The GRACE research question spoke directly to the researchers' own personal and professional reality;

The GRACE sub projects varied greatly in choice of target group, research question and research methods and theoretical conceptualisation;

It was accepted and expected that the GRACE researchers would change in and through the research process;

The attitude of striving towards reflexivity was embedded in a practice of self-care and self-care was constructed as a methodological prerequisite;

The network dimension of GRACE allowed for the management of the diversity within a unifying framework, generating methodological discussion between the researchers and creating a support structure.

The choice of a general qualitative approach

As the connections between gender, ICTs and empowerment in Africa are complex and not well understood yet, we opted for a qualitative research approach.

Furthermore, the project's general direction focused on concerns and questions around women's empowerment; qualitative approaches enable researchers to explore agency and the ways in which agency can be enhanced. Especially qualitative research that incorporates the use of participatory and transformatory action research techniques is eminently suitable to study "women in change" in action. In these approaches the "theory-practice" gap that often plagues research grounded in theory that is developed in contexts external to the research context, is a non-issue (Reason and Bradbury 2001).

The learning that qualitative and action research yields, especially research grounded in positive questioning instead of a focus on problems and deficiency, such as Appreciative Inquiry, is transferable to other contexts when the learning is contextualised in the local context (Senge and Scharmer 2001).

Coherent with the general methodological approach, ICTs as a concept was approached from a user-perspective. Regardless of the fact that the various ICTs serve similar (communication and information) purposes, the actual use of them entails a different reality for users in terms of access, maintenance, control and use. For most users, the categorical concept of ICT or ICTs may not make any sense at all.

Research Methodology

Within the broader methodological framework of research to understand women empowerment in relation to the use of ICTs in Africa, with an emphasis on qualitative methods, all GRACE sub-projects had complete freedom in choosing their research question, target group, research design and research methods. The differences between the various projects were therefore huge.

Some researchers turned their gaze towards their own working environment (Zimbabwe), some focused on their own communities (Uganda), and some even included themselves as research participants (Kenya, Tanzania). Some researchers purposefully sought out the successful cases of women empowerment (Kenya, Tanzania). Others purposefully sought out the most disadvantaged groups of women (Nigeria, Egypt, South Africa). Some researchers focused on the relationship between a specific aspect of empowerment and the use of a specific ICT (Zambia, Morocco, Senegal, Nigeria). Some researchers focused on a specific group of women and attempted to understand their relationship with ICTs (Cameroon) and others focused on a specific ICT and attempted to understand what type of women were benefiting from its use (Uganda).

All researchers to some degree used participant observation and observed their own emotions, thoughts and reactions throughout their entire research process. For the researchers to effectively investigate the user perspective, they had to recognize the respondents' agency, their contexts, and the influences on their minds, while at the same time questioning the influences on their (the researchers') own minds and their own way of seeing things. Commitment to this attitude of reflexivity is however crucial in the striving towards quality in qualitative research and action research (Smaling 1987, 1990, 1995, 1998; Buskens 2002).

In the words of one of the researchers:

Maybe for the first time, I began to see myself in a perspective that makes it possible for me to be an independent observer of myself, and from some distance. I am able to "see" myself as if the "person" I am watching is a separate entity, and yet she is me. GRACE has also deepened my ability to listen to others, and try to understand where they are coming from, why their views have to be different from mine, and yet enriching mine.

Because there was such a difference in research focus, research question and target groups, the designs also differed greatly. Some researchers' main method of verbal data collection was focus group discussions, for others it was collecting life histories. The following techniques were practiced by all researchers to varying degrees, depending on the needs of their specific designs:

Ethnographic fieldwork methods such as participant observation, observation, informal interviewing, writing field notes, constructing time-budgets, keeping diaries, constructing a situational and context specific analysis.

Sociological in-depth interviewing techniques with emphasis on clarifying, summarising, probing, interpreting and confronting.

Action research techniques, such as dialogue (participatory interviewing including self disclosure and external confrontation), Transformative Attitude Interviewing, work shopping and research education designed specifically for every respondent group.

Focus group discussions with an emphasis on awareness of group dynamics and non-verbal communication.

Nvivo computer-aided qualitative data-analysis.

The researchers as Native Anthropologists

One of the unique aspects of the GRACE approach lies in the fact that the 14 research teams comprising the network, lived within the broader contexts in which they did their research. They spoke the local languages and understood the local social and cultural norms prevalent in these communities.

In turning to their own communities for their research, sharing language, ethnicity, religion and sometimes even the village of birth or working in the same organization, the

GRACE researchers operated as ‘native anthropologists’ (Rodriguez 2001; Buskens 2006). This has enabled them to establish close relationships with their respondents; it also has challenged their reflexivity, courage, perseverance and love for self.

Doing research as a “native anthropologist” demands that researchers make an effort to make the familiar “anthropologically strange” while not falling into the trap of “othering” their research respondents. It is very tempting to assume meaning in inter-personal communication before it has been established. As such, the capacity to prevent premature closure of the processes of perception and data-analysis challenged the researchers’ comfort zone and “natural human need of belonging” (ibid.).

Furthermore, the research topic spoke directly to the researchers’ lives. In GRACE, the research question was: “How do women in Africa use ICTs for empowerment?” None of the GRACE researchers would have been able to do the work they do, empowering themselves, if it were not for their use of ICTs. This research focus intensified their relationship with their respondents even more and added an extra dimension of personal involvement in research process and outcome.

Gender Research with women

Research with women is very demanding because women, given their position in androcratic societies are challenging respondents (Anderson and Jack 1998; Maynard and Purvis 1994; Buskens and Webb 2009).

When focusing on the options women users or potential users seem to have, the concept of “adaptive preferences” has to be brought into the equation: women have internalized the myths of gender inequality that are prevalent in their society and have formed an attachment to identities informed by such myths and the practices that are coherent with them (Nussbaum 2000). As such, qualitative and participatory approaches could become part of entrenching and re-enforcing existing gender inequality instead of challenging and changing it. Women may have accepted the “unacceptable as natural” and may share “their truth” from this perspective. If such truth would not be examined, women could be made into “informed” agents of their own disempowerment in processes of participation that were meant to be empowering and transformative.

Research with women focusing on their empowerment or the lack of it in relation to gender issues exacerbates the challenging nature of the research relationship between researcher and research participant even more. Given the research focus of gender influence in the context of women’s empowerment, both female and male researchers will be confronted with their own gendered self and the sexist filters they have. The confrontation with their own gendered self and the experience of the gender dynamics in the research relationship may mean something different for men than for women. Where men could be unaware of many of the unobvious interpersonal communication dynamics, women could lose awareness because they could revert to unexamined judgment.

The more however researchers are prepared to look into the mirror and own what they see, the richer their relationship with their respondents will be, the richer their research process and the richer their data (ibid.).

Women researching women

Most of the researchers within GRACE were women.

The female dyad of female researcher and female research respondent creates even more complex dynamics in the research encounter. A long-time taboo subject, female sexism has now been openly discussed (Chesler 2001). Fear of identification and connection with other women seems to be the shadow force behind female sexism.

Women's sexist attitudes towards other women are linked to a country's general sexism rate, in other words to its patriarchal and androcratic nature and southern Africa can be classified as very sexist (Glick and Fiske 1996, 1997; Glick et. al. 2000 as quoted in Chesler 2001). Women's aggression towards other women expresses itself predominantly indirectly -- in the form of shunning, shaming, judging, and even stigmatizing (Chesler 2001). Even being feminist does not seem to guarantee a lack of hostility towards other women.

Within GRACE, this meant that researchers had to watch carefully their tendency to become impatient with or even judgmental of their women respondents, when these would, according to the researchers' perspectives made choices that would not optimize potential avenues for empowerment. The journey from judgment (which closed the analysis prematurely) to compassionate understanding was sometimes a rather lengthy one.

Research for change will change researchers too

Looking in the mirror and becoming aware of oneself in the presence of the reflection and through this reflection, is a transforming act. The act of self-reflection in itself brings about change (Reason and Bradbury 2001; Meulenberg-Buskens 1998; Van der Walt 2000).

Researchers that are not afraid of change in themselves and their environments will not be afraid to witness and evoke change in their respondents either. It is the willingness to undergo change, to witness one's own change processes and experience the vulnerability that goes with this, that gives researchers the legitimacy to focus with such an in-depth gaze upon their research respondents. Yet necessary as it is, the capacity and the willingness to change, it can be challenging too, even when the change is wanted, foreseen and embraced, because every change also carries loss in it.

Within GRACE this aspect of the research journey came to mean different things for the different researchers. Yet all of the researchers commented on the accelerated changes in their lives. In the words of one of them:

“With GRACE I am undergoing a process of deep change. I changed, and I am using this know-how in my classes, and in my personal research.”

Self care as a methodological prerequisite

Maintaining a reflexive attitude can be very demanding and anxiety provoking for researchers because of the element of self directed critical awareness that is part of all reflection. Furthermore, the processes of change and transformation, which were inevitably stimulated in the researchers, became stressful in themselves. In order to make this research attitude feasible and sustainable in daily research reality, researchers had to learn how to embed it in a general practice of self-care (Foucault 1995; Buskens 2002).

The more the research holds up a mirror for us as researchers, the potentially richer our insights into self and the other become, the more confrontational the research experience will be and the more important self-care becomes. As one of the researchers said: “it is very hard to research yourself” The need to engage a systematic discipline of self care was thus constructed and accepted in GRACE as a methodological prerequisite.

Throughout the project, the researchers were given the tools and the time to practice self-care. They were given the space to discover what self-care would mean individually for them in the context of their specific research project. As the researchers were unique individuals and their projects differed widely from each other, the researchers constructed a self-care discipline, which suited them and their specific reality.

The researchers developed this ability through the training and mentoring offered, and through their own practice of a qualitative research approach that required heightened self-awareness and reflexivity, in conjunction with rigorous attention to coherence in all aspects of their research methodology, methods, articulation of findings, and discussion and interpretation of those findings.

In the words of one researcher:

“GRACE was an eye opener for me as it made it clear how important it is for a researcher to take care of her/himself to achieve a better analytical ability. Previously I have regarded myself as a tool, I am a channel and processor for the research in the most mechanical way possible. Yes, research is always subjective and it is the duty of the researcher to be aware of that and to honestly acknowledge where one is affected by this subjectivity. GRACE though made it clear to me how important self-care is for the researcher, that one becomes a better researcher by honouring one’s psychological and physical needs. This was especially powerful because as a woman I was conditioned to downplay self-care both in my professional as well as my personal life”.

The network dimension

Within all of their differences, the 14 sub projects did speak to each other because there was enough of a shared normative and epistemological stance: all researchers were focused on and committed to the transformation of Africa, aware of the power of knowledge construction processes within processes of transformation and convinced of the importance that these knowledge construction processes are designed and managed by researchers living and working in Africa. Furthermore the researchers shared the general focus on women's agency in relation to empowerment, the awareness of women's adaptive preferences and the methodological direction of qualitative research approaches.

As a research strategy, the network dimension of GRACE was able to harness and optimize the variety between the projects. It enabled the project to yield insights into the various dimensions and aspects of women's empowerment, gender and ICTs in Africa. The 14 sub-project investigations focused on a wide spread of ICTs and involved a wide variety of different women users who faced very different challenges and opportunities. Furthermore, every research team approached the concept of empowerment individually, in response to their specific research context and research focus. Explicating the specific nature of each ICT under investigation, the specific nature of the women engaging this ICT, and the way this relationship developed and evolved, enabled us to speak to the problem of the interaction between gender and ICTs in a concrete, specific and in-depth way (Buskens and Webb 2008).

The GRACE network also became an important support structure for the researchers. It generated its own methodological discussions, which were directly related to the researchers' specific research reality and the sharing and learning created a supportive environment. GRACE therefore evolved from a "researcher collective" into a "virtual researcher network" using the various electronic tools to enhance mutual research support between researchers and between the researchers and the coordinating team, connecting separate individuals within a shared consciousness.

The Grace approach required of the researchers to think "out of the box", away from structured designs and research methods. The open attitude towards respondents needed the researchers to be very present and highly aware, and very resilient. Regardless of their measure of research experience and skill, the GRACE researchers needed a lot of courage. Researcher - support and mentorship thus played an important role in the project. The GRACE researchers therefore not only needed the knowledge and skill to do their research well, they also benefited from having enough methodological insight to participate effectively in general research discussions to consolidate the validity and reliability of their findings and analyses.

The lessons learnt through GRACE

The relationship between women, their empowerment and the use of ICTs in Africa is complex. It has become clear however that the journeys towards empowerment of individual women have to be understood against the background of the pervasive influence of gendered social, cultural, political and religious norms and against the background of a market economy, which is failing Africa in many ways. As one of the research teams stated:

“These programs (structural adjustment programs) have accelerated the deterioration of living and working conditions, along with its multiple consequences: lay-offs, business closures, restructuring the economy along a purely liberal perspective, wage reductions, less buying power for the workers, and flexible staff management for businesses” (Buskens and Webb 2009).

Using the concept of “space”, which is appropriate as the concept of space in relation to women has had and still has the connotations of confinement and restraining freedom, the following rough categorization of the respondents’ options and choices in relation to their use of ICTs against the question of empowerment can be made:

There are women who are *affected by ICTs in a “passive way”*. Their lives have been changed by the various technologies but they are not at all or in a very limited way able to access and use these tools. These women’s lack of access and use is related to poverty and illiteracy and these factors are often completely or partly gender related.

Then there are women who are *benefiting from or who would benefit from “female-only” spaces* created for them through and with ICTs. In these spaces they can find refuge, express themselves and contribute to the worlds of education and economy. It seems that in certain situations, the gendered norms they are facing would make it impossible for them to participate in these worlds through the existing physical spaces. In other words, the gender imbalance is so great in their environments that the “normal”, physical spaces would not give women opportunities to enhance their lives in these fields. The ICT created spaces would be able to offer women this freedom.

The third group comprises women who participate in general and public spaces created with and through ICTs. Whilst *enhancing their lives through their use of ICTs, they are not able to challenge gender imbalance and structural gender inequity* yet. It can even be stated that their use of ICTs contributes to a strengthening of the gender imbalance because the use of ICTs enables these women to better handle their triple roles.

The fourth group are women who, in their use of ICTs are *creating new ICT spaces and are affecting and even changing their environments*. With and through the use of ICTs these women create spaces for them and others to think in, live in and work in.

Whilst these four categories can be constructed as criteria to characterise women’s options and thus group women as such, these categories can also be approached as

scenarios, as stations or stages. Conceptualised in that sense, women could or would be able to have characteristics of more than one stage or be seen to participate in various scenarios.

In every stage, at every station or scenario, the question can be raised what level of empowerment would need to be in place for women to access and use a particular ICT or to participate in spaces created with and through ICTs. Our research indicates that there are certain “empowerment thresholds” at every level, comprising internal and external factors in various combinations. Yet at every level, even at the level where women would have the least choices because of general deprivation of basic necessities (such as electricity) women would express their agency. One of the South African respondents shared:

“I learnt that I can do things myself depending on what I have planned. I have also learnt that I can convince people in taking part in what I want to participate in which shows that I can mobilize people to do something positive.”

It also became obvious that women, whatever their particular station would be, would contribute immediately to their environment and share their gain. Women would even slow down their economic empowerment progress because they would be primarily focused on enhancing their relationships with loved ones and / or having loved ones share in their gain. As one respondent from Uganda shared:

“How can you put business before life?”

When a woman enhances her life through the use of ICTs to the degree that she is able to create new spaces and is really empowered in the sense of creating the life she has reason to value (Sen 1999), the people she loves are benefiting directly and greatly. As one of these respondents from Kenya shared:

“So at the end of it all they were asking me why out of all the people who are interested in the club I am the only lady. I told them that there is always a starting point and if they can see me there, they can also be there. And then also when I get to the labs to fix some of the machines I always call the ladies to come and see how I am doing it just to know that they can actually fix these machines.” (Network Administrator/lecturer, 2005).

It has also become clear that the use of ICTs is not only an act by an individual woman; it is a process that involves all the contexts that are affected by this act. As women are participating in various contexts simultaneously, and many of these contexts are grounded in gender inequality, women’s processes of change and empowerment will impact these contexts directly and immediately and may evoke fights, disruptions, and even lead to chaos. Because women themselves will be best able to decide to what degree they can push their existing ceilings, they have to be the agents of their own development and empowerment. They have to do it in their pace and their way. As one of these respondents shared:

“Either you sacrifice your marriage and succeed in the phone business, or you prioritize your marriage and either operate at a mediocre level or collapse altogether”.

Enhancing women’s access to and use of ICTs requires therefore a transformation (change) of people’s mind-sets and knowledge of the world that has been shaped by gender inequality, and more particularly, by male domination. The male perspective which has shaped African societies and the role of women in the labour market and in the domestic sphere is a key variable of empowerment and disempowerment in the ICT sector.

Yet within these confinements women’s agency did shine through and revealed that at the four various stages discerned at women’s journeys towards empowerment through the use of ICTs, women would immediately share with their direct environments any gain they would reap. This finding is coherent with general predictions that women’s empowerment is one of the major mediators for social and economic change (Sen 1999).

Conclusion

It is recommended to step up the efforts to support and enhance women’s access to and use of ICTs. Not only will this directly benefit women’s well being and serve the purpose of social justice, but also women’s direct environments will reap the benefits of women’s empowerment with and through the use of ICTs. Our research has shown that when women are given the opportunities and resources that they can make optimum use of the empowering potential of ICTs.

As any change pertaining to women’s gendered positions and relationships will have repercussions for them - some of which might be quite severe - it is important that women themselves will be agents of their own development and empowerment processes. They will know best how to push their ceilings and what they need in order to do so. And as their walk to freedom has to be undertaken in a world that is limiting their capabilities through the pervasive gender images and norms, efforts to influence such would impact positively on their journeys towards empowerment through the use of ICTs.

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RFIP considerations for reducing waiting times in a community health clinic in the Western Cape

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Abstract

In South Africa the provision of health care for all citizens is considered a fundamental right in terms of its constitution. The majority of the population is fighting unemployment and poor socio-economic conditions and rely on community clinics to provide the healthcare services needed. However, the current services rendered at public clinics have resulted in dissatisfied patients and frustrated staff. The health industry portrays a very complex environment in ensuring service. Quality of service is measured in terms of patient processes which include patient waiting time. The quality and flow of information is directly related to the patient processes. This purpose of this paper is to examine the flow of information at community clinics and the effect that it has on the patient flow. It also looks at the quality of information and considers how RFID technology could be used to improve healthcare services. This is an exploratory study to identify information flow issues that impact healthcare service at a community health clinic that result in long waiting times for patients. This study is part of a research agenda for a larger research study in which information flows and ICT utilisation in healthcare are investigated.

Key words. Waiting time, Information flow, data quality, rfid

Introduction

Everyday all over the Western Cape patients spend lengthy periods of time in unpleasant conditions in community clinics in search of treatment and medication. This results in a build up of tension for both staff and patients. Issues such as overcrowded reception areas, misplaced folders, and finding lost folders increase the levels of chaos and impact negatively on the flow of information.

This research aims at investigating the issues that need to be considered for reducing the waiting times of patients. This is part of a larger study in which the main point on the research agenda is to study information flows in order to find mechanisms that could optimise the flow of information to support the information needs of healthcare workers in different healthcare contexts. Some aspects that could be considered for reducing the waiting time of patients are the utilisation of technology, the quality of information and the actual flows of information. It is important to note that each of these aspects influences each other and a study focusing on only one aspect may offer an over simplified solution to a complex problem. The research question for this study is to establish the aspects that could impact on the waiting time of patients before they receive treatment. The supporting sub research questions concern: what are the typical information flows between healthcare stakeholders; the quality considerations of healthcare data; and the technology considerations to identify patients. This exploratory study attempts to obtain a better understanding of the above aspects in order to direct further research. Although technology is used in healthcare to support various healthcare processes, this study focuses on technology that can be used to

identify patients. Data and information is used interchangeably for the purpose of this study. Although this study is based on observations at 33 community health clinics (CHC) in the Western Cape over a two year period, the discussion refers to a specific CHC to illustrate the information flows in such a context. This CHC provides a healthcare service to a poor community in the Western Cape.

This paper is organised to first explain the context of the CHC followed by a discussion of patient data, the quality considerations of the data and Radio Frequency identification (RFID) as an example of possible technology that can be used. Next the case study is explained in terms of the information flows and then an analysis of the collected empirical data. The implications are indicated to use in further research studies. Although the findings are not conclusive at this stage, sufficient insights were obtained to proceed with a more focused study around information flows that ultimately could result in reduced waiting times for patients.

South African Healthcare

In terms of the Constitution of South Africa basic healthcare is considered a fundamental right (Bill of Rights, 1996). A Comprehensive Service Delivery Healthcare 2010 plan was released in May 2007 and its vision states equal access to quality care for all citizens. The goals of the Western Cape Health Department include accessibility, appropriateness, affordability, equity, effectiveness and efficiency of services. This plan states that the development of reliable and valid information systems is regarded as an extremely high priority for Health Care 2010.

The Western Cape covers an area of 129 386 square km and has a population of approximately 4.2million people (Census: 2001) The following table adapted from the service plan represents the need to address public health quality information and process flows as patient numbers estimated to increase drastically by 2010.

Table 1 Estimated increase in headcount figures by 2010 (Western Cape Department of Health, 2007)

Sub District	Number of CHCs : 40 hours per week	Population served per CHC (Total population)	Estimated Headcount per annum 2010
Northern	4	75,333	238,487
Western	5	75,364	298,232
Southern	5	98,494	389,762
Klipfontein	5	79,197	313,402
Mitchells Plain	4	115,264	364,900
Tygerberg	7	75,792	419,896
Khayelitsha	4	94,546	299,313
Eastern	5	77,564	306,940
Total: Cape Town District	39	85,236	2,630,933

The purpose of Community Health Clinics (CHC) is to provide free, quality health care for all citizens. It mainly serves the public who fall within lower income category groups, and who are facing unemployment and poor socio-economic conditions. The size of CHC's varies from small units serving ± 500 people to large ones serving up to 2500 daily. These services are currently provided by two different spheres of government, i.e. local government, the City of Cape Town, and provincial government, Western Cape Health Department.

CHC: Patient Data

Typically, ICT services at community clinics are still limited to capturing demographic information (name, surname, identity number, address, number of dependents) and printing patient details and labels for medication. Patient folders are still paper-based in most CHCs although a computerised district health information system (DHIS) is used in most public healthcare facilities. The aim as set out in the new service plan is to network all clinics so as to improve service administration. In July 2007 the first millionth patient was registered onto the Primary Health Care Information System (PHCIS). Moser (2004:1) argues that the strengthening of electronic flow is crucial to improved health care delivery, quality and efficiency. This is true as more valid information is required for an information system in order to produce relevant and quality data. It is often the misconception that ICT services result in less work when it means more work needs to be done. This is because the electronic flow needs to be made and managed (Moser, 2004:7) Moskowitz *et al.* (2006:2) in support of this states that in organised clinics the patients tend to spend less time waiting and the clinical staff, including the doctors are more productive. New versions PHCIS are expected to be released in the future with more clinical features embedded into it.

Moser (2006:2) argues that information technology is a powerful means of improving public service delivery particularly in the health sector. Rich *et al.* (2007) supports this with the claim that inefficient use of resources throughout the clinic results in bottlenecks and delays in patient and information flow. For instance, if patients have appointments for a particular day and time then preparation can be made for their arrival saving patient waiting time and staff effort. In this way an effort is made to improve quality service delivery. This is further emphasised by Rich *et al.* (2007) who argues that inefficient patient flow compromises both quality and satisfaction of patients and staff. Collin (2004) claims that only 3% of 64000 hospitals in the United States have an integrated hospital information system to manage patient records and care which leads to errors that may result in death. Information needs to flow across hospital networks in order to ensure efficiency. In South Africa, particularly the Western Cape, information is only accessible via tertiary hospitals.

Data Quality

Data quality problems not only have severe financial and operational consequences but can impact life and death decisions (Long *et al.*, 2001). Healthcare policy makers and industry partners consider ICT to address cost, quality and access issues and specifically how electronic health records with patient data can contribute to these issues (Davidson & Reardon, 2005).

Gendron and D'Onofrio (2001) based their study on the original twenty data quality dimensions which Wang and Strong (1996) reduced to fifteen. The reason was that they felt that some of the eliminated attributes may be relevant to the healthcare sector. They found that the fifteen quality dimensions identified were sufficient to define data quality in the

healthcare context but suggest that each domain within the healthcare sector set domain specific dimensions. Completeness and accuracy were identified by Häyriinen *et al.*, (2007) as the aspects mostly explored when they reviewed several studies from the literature on electronic health records. Their research confirmed that the quality of data is particularly important in patient care. Heeks (2006:73) suggest a CARTA (namely: Completeness, Accuracy, Relevancy, Timeliness and Appropriateness) model to measure data quality in healthcare. The Canadian Institute for Health Information (CIHI) recognised the importance of data quality in healthcare and implemented a framework to evaluate it (Long *et al.*, 2001).

Their framework is a four level conceptual model designed to standardise and facilitate systematic quantification and measurement of the quality of their data. It has eighty six criteria divided into twenty four characteristics, divided into five dimensions, namely: accuracy, timeliness, comparability, usability and relevance. The CIHI has contributed towards a comprehensive and systematic data quality program to implement and monitor a data quality framework which has a comprehensive list of data quality definitions (Mitchell & Brown, 2002). This framework was expanded by Kerr (2004) who defined her data quality framework for healthcare in New Zealand.

According to Heeks (2006:71) there are four elements that lead to data problems and should be identified and dealt with immediately in the most appropriate manner. These are incomplete data, old data that needs updating, erroneous data and poor data quality. These elements apply to all industries including government, health and corporate. The CIPSO model refers to five stages of data life cycle in a system and is one of the best ways to identify potential areas of problems. The five areas include capturing, input, processing, storing, and output of the data. According to Heeks (2006:74) the causes of the data could be separated into two distinct areas as hard or technical problems and soft or human problems. It was found that data at the primary level in South Africa is of poor quality and this impacts the flow of data with many problems associated when data is aggregated for reporting systems (District Health Information System Guidelines). The lack of feedback to those collecting the data is mentioned specifically and often the many forms are duplicated.

The quality dimensions that are common to most data quality frameworks are represented by CARTA and these will be used at this stage to do an initial assessment of the CHC data. Any further studies will need to unpack the complexities of data quality in healthcare to ensure that all quality aspects are sufficiently covered.

Technology to Support Information Flow

There are many different types of technology used in healthcare to identify patients ranging from very basic cards to bar codes and more recently radio frequency identification (RFID). A RFID system has the following components: a RFID tag to store data; an antenna to support reading and writing of data; a reader to encode/decode data; and a host, the information system. RFID technology could be used in healthcare and it supports the five rights of medication safety, namely: correctly identify the patient, right medication, dose, route and time (Collins, 2005). In addition to identifying patients, RFID technology can also be used to track patients when they move around. RFID can add intelligence and capabilities to organisations because it can identify, track and trace entities (Tzeng *et al.*, 2007). Some of the problems associated with RFID use in healthcare are mentioned next. Although this technology has been successfully used to track stock, assets, etc., when used with

persons, several privacy and security issues need to be considered that may impact its acceptance in healthcare (Sotto, 2005). Patient data stored on tags may be altered by unauthorised persons and could unknowingly be read by other compatible readers. The cost of RFID technology is a factor and depends on the type of tag (active or passive) and frequency of the system. Higher frequency RFID offers a better range and transfers data faster but uses more power (Harper, 2005; Tagsys, 2004). Although readers are still relatively expensive, the cost of RFID technology is expected to drop. RFID technology is still more expensive than for example printed bar codes.

Tzeng *et al.* (2007:609) make several propositions with regards to how RFID can add business value and the one applicable to this study states that “*through the intelligence built into systems and extended availability of intelligent support systems, RFID technology can optimise the patient-care process*”. This study only focuses on the identification of patients with limited data stored on RFID tags and does not consider the active participation of patients in their own treatment processes, to enhance communication amongst healthcare workers, etc. The moment electronic patient health records are properly implemented and adopted RFID can be better utilised. At this stage RFID applications are still in their infancy and their contributions not yet proven (Tzeng *et al.*, 2007).

When considering the adoption of technology it is important to also consider the social aspects as well because that determines how well humans will interact with the technology. Fisher and Monahan (2008) investigated the social dimensions of RFID systems in hospitals. They found that the social and organisational factors contributing to the success or failure of RFID systems need to be further investigated. They specifically note that RFID systems were not designed based on healthcare needs and often healthcare centres have to adapt to RFID systems instead of vice versa. These constraints refer to the maladaptation of this technology itself to the healthcare setting where it is used and the organisational challenges for healthcare to utilise it. RFID systems can contribute to the interoperability problems of healthcare systems and may not be compliant with medical standards and regulations.

Healthcare professionals, especially nurses indicated that they found RFID systems to contribute to their workload taking the emphasis away from patient care to keeping the systems operational (Fisher & Monahan, 2008). Some of the lessons learnt from using wireless communication technology to track patients in a rural CHC in South Africa were that organisational processes and practices need to be understood to ensure that technology solutions support the healthcare activities; processes to ensure data quality are essential; and ongoing training and support of local healthcare workers are required to ensure sustainability (Hanmer *et al.*, 2006).

No single technology satisfies all the different needs in healthcare and a combination of technologies may still be preferred (Halamka, 2006). RFID could be utilised in healthcare to improve healthcare services in situations where staff members need to be utilised in a more efficient way as a result of staff shortages, and to ensure productivity (Wicks *et al.*, 2006:3). The possibility of using passive RFID technology to identify patients in healthcare services is considered for the CHC case and discussed in more detail later in this paper.

Research method

This study is based on observations done at 33 community health clinics in the Western Cape over a two year period. The observations were focused on information flow in relation to the patient flow and involved direct interaction with both staff and patients. The observations included the study of the movements of patients and their information in order to understand and evaluate the processes to ultimately reduce the patients' waiting time to provide a more effective healthcare service. These observations are presented in diagrams to depict the flow in order to provide for easier analysis. The observations are organised according to themes that were identified. Furthermore an analysis of the CHC's data was done to establish the data quality problems they experience and in addition the possibilities of using RFID to address these were indicated. Findings were derived from the analysis to answer the research questions and to form the basis of further research.

Information flows and other observations in a CHC

Although all clinics are not completely identical in their functioning, they are all very similar in the functioning of their overall information flow. Clinics are divided into various sections: reception, preparation, pharmacy, dressings, trauma, and doctors' consultations. Figure 1 illustrates the various sections of the clinic and how the patient and information flow function through the healthcare processes. The waiting times are also indicated at the points where patients either wait to be consulted or wait for their folders. A solid flow line indicates that patients and their data flow together whereas dashed lines indicate only patient data flows. The arrow indicates the direction of the flow.

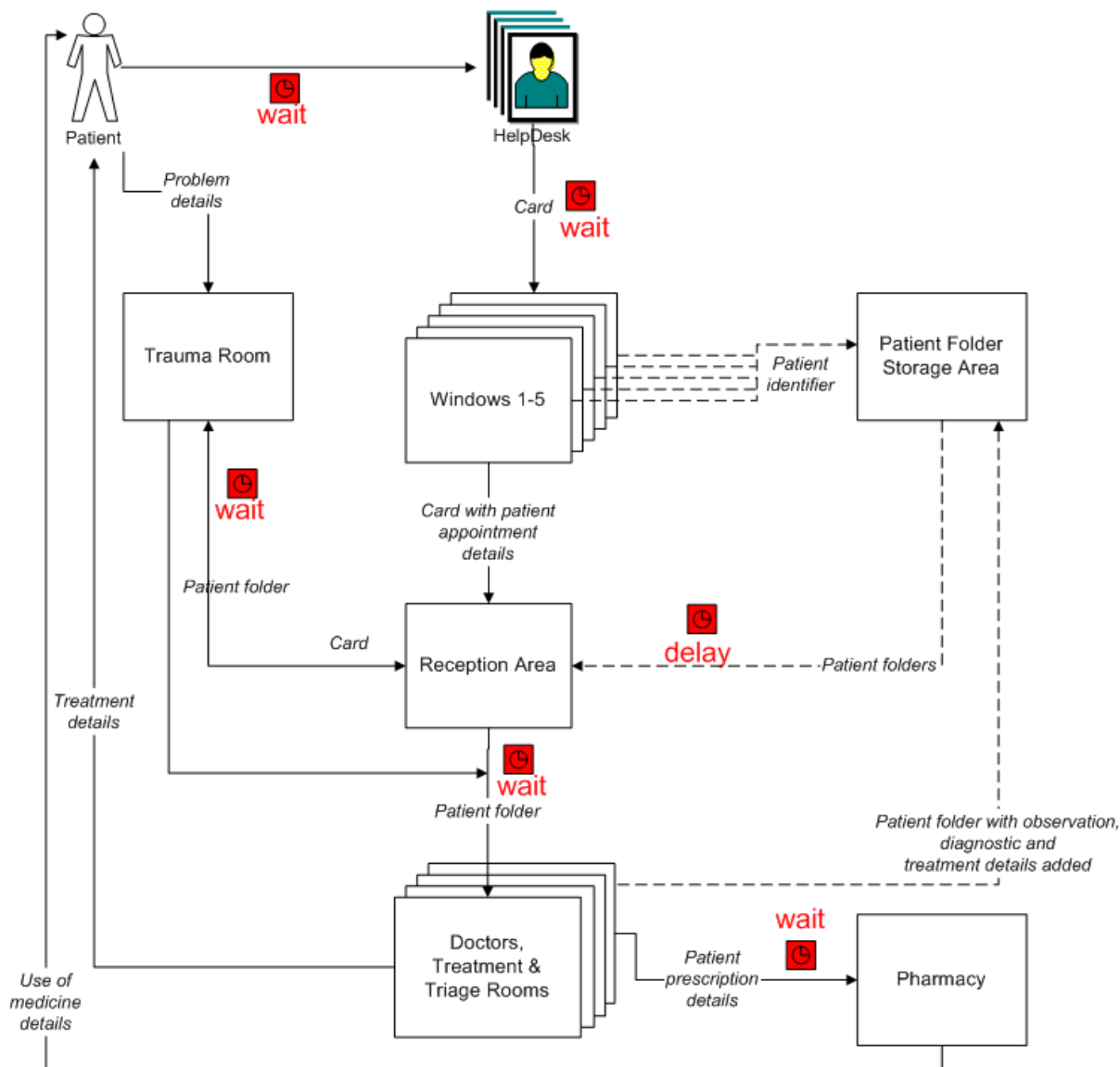


Figure 1. Information flows between healthcare services and waiting times at a CHC

All patient folders contain clinical information and are stored in the reception. At all clinics the patients on arrival are first required to check in at the main reception where they queue in order to obtain their patient folders. The patient submits the card; the admin clerk verifies the details on the system and searches for the folder within the filing shelves. Patient cards contain demographic information and hand-written dates of the next visit. The dates are written in by the receptionist who would normally just allow a month lapse, or if the doctor needs to change the date during the consultation. Patients often tamper with these dates to suit their needs since there is no record except the handwritten date on the card which is retained by the patient until the next visit. The first four hours of the morning (7-11 am) reception areas are heavily overcrowded by patients who are expected to wait for long hours in long queues with inadequate seating available at all facilities. Patients become frustrated and the staff members as a result are tense and function poorly. Once the folder is obtained patients speed off with their folders to the next station and join one of the queues. The staff moving patient cards and folders do so in batches, this result in a further time delay as illustrated by Figure 1 between the windows and folder storage area and reception area (indicated by the

dashed lines).

The following table represents the results of observation completed on 22 March 2006 at one of the CHCs. This clinic deals with specific issues at a particular window and had introduced appointments but were still faced with the clog up in reception in the morning period.

Table 2. Issues and observations

Issues	Observation
Administrative Staff	<ul style="list-style-type: none"> • All clinics are understaffed resulting in other areas such as pharmacy and doctors consultations not functioning on time • Staff are not sure how to handle new patients • Often patients only want to ask questions and still have to wait their turn • When all the reception staff are rushing around to find folders, then there is no one to answer off-the-hook calls • Very often the patients would subject staff to their irritation as a result of being victim to a dropped card at one stage and this usually just adds to the frustration levels
Data/information	<ul style="list-style-type: none"> • Overflow of patient folders leads to the risk of misplaced and lost folders. Often folders are left in the room where the patient was seen and/or not returned to its proper location • Misfiled folders are impossible to find as a result of the clutter of stacks of folders in reception. • The manual folder system has no backup, so if a folder is lost a new folder has to be started from scratch. • Duplicate folders created as a solution to lost folders renders lesser crucial patient information availability. • Duplicate filing systems leads to confusion and patient folders are mixed up, leaving the staff even more frustrated.
Waiting time	<ul style="list-style-type: none"> • Long waits for patients in reception areas and hallways, and may or may not even get to see a doctor in the end. • One of the problems is what happens when as a result of the chaos, the card is dropped behind the scenes and when the patient becomes impatient because it takes too long to find the folder.
Physical environment	<ul style="list-style-type: none"> • Overcrowding. There are many who simply hang around at clinics as a result of poor socio-economic factors, and this contributes to the overcrowding state • Seating arrangements are inadequate and on more than one visit patients had wet themselves in their seats as they were afraid to move and lose their places • At many clinics the windows are not even structured, patients simply queue at any window where there is an available staff member. • Labels are printed which are used on the patient medication as well as on the folder. When a printer goes down the process is slowed down further. Problem is that most clinics have just one label printer to share with the reception staff.
Communication	<ul style="list-style-type: none"> • The information available to patients is insufficient. Patients enter the clinics and often spend too much time queuing at the wrong window at reception and this situation impacts negatively on the patient waiting time • It is difficult for staff and patients to communicate effectively through the windows at many clinics. Very often patients have to repeat themselves and staff are forced to shout • At clinics many of the microphones to call out patients are not functioning and often the readers' accent is difficult for the patient to understand and as a result they miss their places when their names are called. This adds negatively to the flow as the patients folder will not get re-shelved until the end of the day and it will be impossible to find later on.
Healthcare service	<ul style="list-style-type: none"> • At some clinics appointment systems were introduced, however as a result of the large headcount and the staff shortages it is almost impossible to run as scheduled. Five CHCs have introduced appointments to the patients. Many patients are found having to bribe staff for appointments and speedy service. • Large volumes of patients lead to relatively short consultations which could minimize the quality of service presented • Most clinics have adopted methods of their own as an attempt at somehow improving the patient process. For instance instead of having screaming patients waiting at the reception windows, at the one clinic the patient on entry would place their card at one reception window and then take a seat and wait for their name to be called so they may collect their patient folder and then proceed on to the next station.

The following findings are derived from the above issues:

- Administrative staff members are forced to provide a service to CHC patients under pressure with data/information insufficient for their needs resulting in high frustration levels of waiting patients
- Patient data/information is often misplaced, lost, duplicated and mixed up making it difficult for staff to match the correct patient folder to the correct patient resulting in frustration in both patients and staff with longer waiting periods
- The physical environment does not support effective service of the large number of patients with staff finding it difficult to correctly identify patients and respond to their specific needs. Patients have to wait in an environment that adds to their discomfort
- There are communication problems between CHC staff and patients resulting in the capturing of poor quality data, locating the correct patient data and delays in the healthcare service often with patients waiting without knowing the reasons for the delays
- Although individual CHCs introduced several mechanisms to improve the servicing situation at the respective clinics, these are not sufficient to provide a proper service to patients who require treatment

The data/information aspect is now further analysed according to the CARTA criteria. The following table indicates the issue of data quality of PHCIS on the observations.

Table 3. A representation of CHC in terms of Carta.

CARTA	CHC DATA ANALYSIS
DATA COMPLETENESS	Often the data capturer would only complete the mandatory fields and though the idea is to complete all details and more fully at a later stage but this almost never happens due to high frustration levels and time constraints. Entering the identity details of a patient is a mandatory field and on one occasion the capturer had found the patient based on name, surname, and year of birth, and simply made up the day of the month as the patient, who was old could not remember the exact day.
DATA ACCURACY	The accuracy of data is mainly dependent on user and technical system checks. The technical checks refer to field validation checks. However when the user enters incorrect information the system does not always recognize this. At a CHC the majority of the patients reside in the township and are of Xhosa speaking origin, however the majority of the staff on board are Afrikaans speaking. As a result input errors with misspelt names are common, as well as processing time is increased.
DATA RELEVANCE	<p>Relevant data enables effective decision making. During the first phase of the PHCIS system the focus is mainly on recording up to date patient demographic information and having every patient registered on the system. No clinical information has been recorded at this stage as yet. It is important for the capturer to search the system thoroughly before adding a new patient, so that if the patient had previously been to an academic hospital that information could be merged.</p> <p>The following is a statement made in the new service plan which emphasises the need for relevant data in order to make sound decisions, the “lack of relevant information, e.g. the full package of comprehensive PHC is not yet implemented and therefore a complete set of related data is not available.” (Comprehensive Service</p>

	Plan, 2007:4)
DATA TIMELINESS	Timeliness of data refers to the ability of a system to deliver the required data when needed, this makes the system reliable. Data duplications are managed by a dedicated reception staff member who would view the duplication list and respective patient details and from here gather whether the record should be merged or deleted. These details are then forwarded on to the system controller who deletes or merges the data. However, the monthly delay in updating records renders the system with inaccurate details at any given time if a report were to be run. This is the result as the system can only provide information that is known.
APPROPRIATENESS OF DATA PRESENTATION	The appropriateness of data representation refers to the reporting capabilities of the system. The system runs reports on the number of duplication, which displays more than one patient record with the same patient details. The system represents its data in a very simple and efficient manner. Users have the ability to do an on-screen query regarding the patient records fields, which include patient number, name, surname, address, and more. This information can then be printed; it is also printed out on labels which are stuck on the patients' medication. There are also issues of privacy and security as there seems to be too much information displayed on patient medication in cases where it is lost or misplaced

In terms of Carta it is clear that the quality of the PHCIS data is insufficient to support its effective user. Data quality problems are associated with every single quality criteria. This means that the quality of information flows are impacted negatively. This poor quality results in bottlenecks, and disrupts the patient flow which means longer waiting times for the patient. Next, RFID is considered as a possible technology solution to address the above problems. Although a RFID solution can be implemented in different levels of sophistication, the first step is to use it only for patient identification. A proper integration with the PHCIS with an electronic patient health record allowing healthcare workers to capture clinical and treatment details should eventually be considered. The suggestion is to use RFID passive tags that replace patient cards. A reader is required at the reception to read the patient identification and send that data to the PHCIS. A request for the patient folder is sent to the patient folder area. Folders are located and taken to the reception area. The problem would still be to allocate the patient to the correct window, i.e., to send the patient folder to the correct window where the patient will wait. This suggestion will need some queuing mechanism to allow patients to be serviced at the correct window in the sequence that they have arrived or according to their pre-arranged appointment time with the folders then to be in the same sequence at the different windows. There could be other readers at other points to track to progress of the patient, i.e. at the different treatment rooms, the pharmacy and also before folders are returned for storage.

This proposed RFID solution is now considered in terms of the different problems to evaluate its potential to address data quality problems and long waiting times. Staff can now concentrate on dealing with new patients to issue new tags (data need to be captured onto these tags) or with patients with inquiries. Patients with tags can immediately go to the waiting area. Data quality should improve because the locating of folders will now be more effective; duplicated data should be reduced; more attention can be given to capturing all the required data to improve the completeness of the data; reporting of number of patients seen as well as aggregation of data should also be more effective since patient data will be more accurate and complete. Attention still need to be given to the design of the physical

environment to address the concern that RFID technology is not developed with healthcare specific needs in mind. RFID technology enables more effective identification of patients which should minimise the communication problems between staff and patients. It can contribute to more effective information flows. The use of RFID technology can contribute to a more effective healthcare service, but then only if all the RFID implications in such an environment have been carefully considered.

Limitations of the study

This study has been limited to 33 community clinics in the Western Cape that are using the Primary Health Care Information System and more intense observations of one CHC. An average community clinic in the Western Cape would service about 600 patients per day with a staff of about 1 pharmacist, 2 pharmacist assistants, 3 nurses, 2 doctors, one trauma unit. The observations focused more on the administrative aspects of the CHC healthcare service and patient and healthcare professional views were not considered at this stage. Patient flows were considered from the point where they enter the CHC and then how they proceed through the CHC and the observations were from an administrative point of view. In a further study patient experiences from their viewpoint as well as healthcare professionals' view on their ability to provide an effective healthcare service in terms of information, its flow and technology need to be considered.

This study is limited and all stakeholders of all clinics should be interviewed in order to do a proper analysis – at this stage the observations are more exploratory where issues have been identified but now these need to be more formally investigated – this can be done in further research.

Conclusions and recommendations

This study investigated the flow of information, quality of data and waiting times issues that may impact healthcare services at a CHC. RFID technology was considered as a possible patient identification solution to improve the quality of patient data and a more effective healthcare service that would result in a shorter waiting time for patients. Many issues were identified that require further more detailed investigations. The relationship of the issues on each other should also be investigated. There will not be an easy solution and the mere introduction of a technology solution may be pre-mature when the social implications have not been fully investigated.

The aspects that could impact on the waiting time of patients in a CHC was the main focus. The typical information flows between healthcare stakeholders in a CHC was identified and depicted for a specific CHC. Waiting points on the flows were identified to establish where the focus should be. The quality considerations for patient data were identified and all these contributed towards an improved understanding of the issues that impact the healthcare service at a PHC. Further research should focus on all aspects that impact information flows in healthcare. The quality of data at the different points and as part of information flows need to be identified and considered. The technology needs versus how technology enables and constrains healthcare stakeholders with servicing patients and technology to support information flows are points on the research agenda to investigate the successful adoption of appropriate ICT in healthcare. Technology solutions in healthcare can address problems but then only if all the social aspects are also considered.

Even though the results of this study do not offer any solutions, it is still possible to address the specific aspects identified and presented. It is also possible to use these results in developing a framework that can be used to investigate information flows in different healthcare contexts. The healthcare context is complex and all the different research findings contribute towards a comprehensive framework that can be used to research ICT related problems in healthcare.

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Acknowledgements

This paper is based on research funded by Academy of Finland grants no. 39187 (INDEHELAMethods,19982001), 201397 and 104776 (INDEHELAContext, 2003, 20042007): www.uku.fi/tike/indehela

The authors wish to acknowledge:

- the assistance of the Department of Health with this research
- Prof David Kelso for his valuable contributions.

Factors influencing faculty adoption and utilization of networked learning environment in higher Education- comparative analysis of private and public higher education institutions in Sub Saharan Africa

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Background

The influence of information technology (IT) in higher education cannot be over-emphasized. The recent advances in IT and particularly the pervasiveness of World Wide Web (WWW) and the widely availability of the Internet is revolutionizing the application of technology in higher education. The use of IT in higher education extends beyond business use of IT for administrative and processing purposes to channel of delivery of educational materials and instructions. The Internet and the WWW are reforming classroom from hitherto passive to interactive learning environment (Walker, 2004; Cain, 2000; Helford and Lee, 2001; Pedroni, 1996). IT are changing the teacher's role from information giver to facilitator, adviser, guide, coach, co-learner, mentor, resource and technology manager, and mediator to the students (Shamoail, 2005).

Statistical evidence from various surveys (The Campus Computing Project, 2007) confirmed the growing importance of technology in higher education. Higher education institutions around the world including those in sub-Saharan Africa are investing huge resources developing infrastructure for networked learning environment. Specifically, most of these institutions acquired major brands of networked learning information systems such as Blackboard and WebCT. Some university developed proprietary solutions and some adopted customized tools like BSCW. The application of IT in higher education has given us distance learning, e-learning, and hybrid learning. Higher education environment is being redefined as networked learning environment (NLE). Networked Learning Environment (NLE) is greater than just bringing courses online, it is about learning that takes place in a vibrant community of people and resources. It is the learning that utilizes the Internet and limits the barriers associated with distance and time enabling any students and instructors to access any learning resource at anytime from anywhere (Pittinsky, 2004). IT presents great potential for instructional improvement by providing ready access to information and allowing more interaction between teachers and learners (Hill, 1997). There has not been any evidence that students in developing countries as well as sub-Saharan Africa are different in terms of their interest in technology and how it could enhance their learning experience. Of course, there is limitation imposed by the socio economic situation of developing countries.

While IT enables changes and opportunities in higher education through different approaches to teaching and the way the students learn and interact (Park 2003; Alavi, 1994; McKendree et al. 1998), faculty adoption and utilization of IT has remained low (Surry and Land, 2000). Despite the investment of higher education institutions in IT, instructional integration of IT still remains a big challenge (Anderson et al., 1998). One of the main reasons associated with this is the low adoption and utilization rate among higher education faculty and instructor (Anderson et al., 1998). Since adoption and utilization of technology is a complex process that is influenced by many factors, understanding these factors become an essential issue to instructional integration of IT. There have been many studies that examine the adoption and utilization of information technology in different

organizations and some studies have specifically examined adoption, diffusion and utilization in higher education.

Purpose of the Study

The purpose of this study is to investigate factors that enable or hinder the adoption and utilization of a technology innovation in higher education in sub Saharan Africa. The knowledge of these factors could assist organization in intervening and adopting some policies that address the main issues and thereby facilitate user's effectiveness, organizational improvement and efficiency. This study could also assist the higher education management, the designers and the administrators of networked learning environment to understand the reason why some faculty use the technology and why others resist. In information systems research and practice, acceptance and usage of technology artifacts like networked learning environment are essential to the success of the implementation, realization of IT value and return on investment. Therefore, investigating factors that affect usage and acceptance is of paramount interest to technology vendor and organization's executive. Considering the growing pressure on higher education for performance, reduction in finances and other resources, declining students enrollments and diversity among students (Davidson-Shivers, 2002), it is particularly important that higher education institutions understand the factors that could contribute to the success of one of the solutions (i.e. technology) they have adopted for educational reform (Ely, 1999). The study is also interested in comparing the adoption and utilization rate between private and public higher educations. The comparison will enable us to determine the role of funding in the acquisition, adoption and utilization of networked learning environment and therefore able to advice administrators and decision makers are organization level and policy makers at national level. No study had hitherto examined such relationship.

The main objectives of this study is to first examine if all the factors that had been found to be influencing the adoption and utilization of innovation applies to adoption and utilization of networked learning environment in higher education. The study will specifically validate the use of TAM and determine which of the factors has the main predictive value for the adoption and utilization of networked learning environment by faculty.

Statement of the problem

What are the main factors influencing faculty adoption and utilization of networked learning environment in higher education?

Main Research questions

What are the factors influencing faculty's adoption of NLE in higher education in sub Saharan Africa?

Sub questions:

1. Do the global factors influencing faculties' adoption of NLE in higher education also apply to sub Saharan Africa?
2. What is the role of financing and ownership structure on adoption and utilization of NLE?
3. Could the synthesis of DOI, TPB and TAM models be used to explain the adoption and utilization factors?

Significance of the study

Many higher education institutions including some in sub Saharan Africa are spending significant amount of money and devoting other resources on the implementation of networked learning environment. Despite the perceived usefulness of networked learning environments, they are still often underutilized and user's acceptance is usually low. Understanding the reasons for underutilization and lack of user's acceptance remain an important issue to university administrator, and information systems practice and research. Without adequate educational system, we cannot be talking about any form of development and how ICT could help in the process. It is thus imperative that we have good knowledge of what the trainers (faculty) require to enhance their productivity. Many ICT initiatives in African universities are hinged on Networked Learning Environment. Many universities are promoting online education, decentralized campus system, Open University and other approaches that heavily depend on NLE.

Despite the numbers of studies on the adoption and utilization of innovation, only few have holistically combined the main theories and models to examine the factors that affect the adoption and utilization in higher education environment, especially in sub Saharan Africa. Thus, the findings of this study could add to the existing knowledge of adoption and utilization of networked learning environment in higher education institutions. This study will add the perspective of developing countries to the knowledge of adoption and utilization of networked learning environment. The assumptions that are based on the context of western industrialized countries could be clarified through this study. Understanding the psychological, behavioral and other external factors could be helpful for proper design of networked learning environment that will consider these characteristics. A well designed NLE could increase the ease of use which could lead to higher adoption and utilization rate. It is nevertheless important to examine the factors that affect faculty adoption and utilization of NLE to better realize its value and to determine the new approaches that are needed to transform the potential of new technologies into new methodological approaches (Ruschoff and Lund, 2003).

Assumptions and Limitations

This study assumes that the respondents will objectively, accurately and truthfully provide response to the survey questions. The study also assumes that all faculty have equal access to the networked learning environment. It was also assumed that the use of network learning environment is not mandatory. It was assumed that the faculty have equal opportunity for training and support and that they are duly informed about the availability of NLE at their university.

This study is limited by the voluntary participation of the higher education institutions and their faculty, this may affect the response rate and the findings. There is also tendency that many institutions in sub Saharan Africa will not have NLE or that the core of their NLE is meant primarily for external students or they are part of a consortium. However, adequate attention will be paid to these issues to ensure that their effects are mitigated. The study may not be able to contact all faculty in the region and also the study may not be able to examine all possible factors that affect adoption and utilization of innovation due to scarcity of time and resources, but efforts shall be made to include most factors that have been found and the study will be careful to identify any new factors that might evolve from the data.

Literature Review

Introduction

Previous research on explaining and predicting intention and behavior usually use well known theories and model which includes – technology acceptance model, theory of reasoned action, theory of planned behavior and diffusion of innovation. All these theories and models are reviewed in the context of their applications in higher education. This review elaborates on the factors that have been identified in the literature as influence on the adoption and utilization of networked learning environment. Extensive review of the concept of the networked learning environment is presented and the review concludes with synthesis of the existing findings on the phenomena of interest.

Network Learning Environment

Recent advances in technology foreshadow a day when distance education will connect a student to a network of resources (Chute et al., 1997, pg 75)

According to Pittinsky (2004), the co-founder of Blackboard Inc. the author and vendor of Blackboard™, a course management system with high global installed base, Networked Learning Environment (NLE) is greater than just bringing courses online, it is about learning that takes place in a vibrant community of people and resources. It is the learning that utilizes the Internet and limits the barriers associated with distance and time, enabling students and instructors to access any learning resource at anytime from anywhere. Chute et al. (1997) characterizes NLE as an integration of voice, video, and data connections among learners, instructors, experts, virtual libraries, the internet, and support services. This environment enables distance learner to have both synchronous and asynchronous connectivity to those resources (see Figure 1). If NLE is utilized effectively, it can make education, learning and training become more accessible, convenient, focused, effective, and cost efficient for both the learners and the educational services providers (Chute et al. 1997)

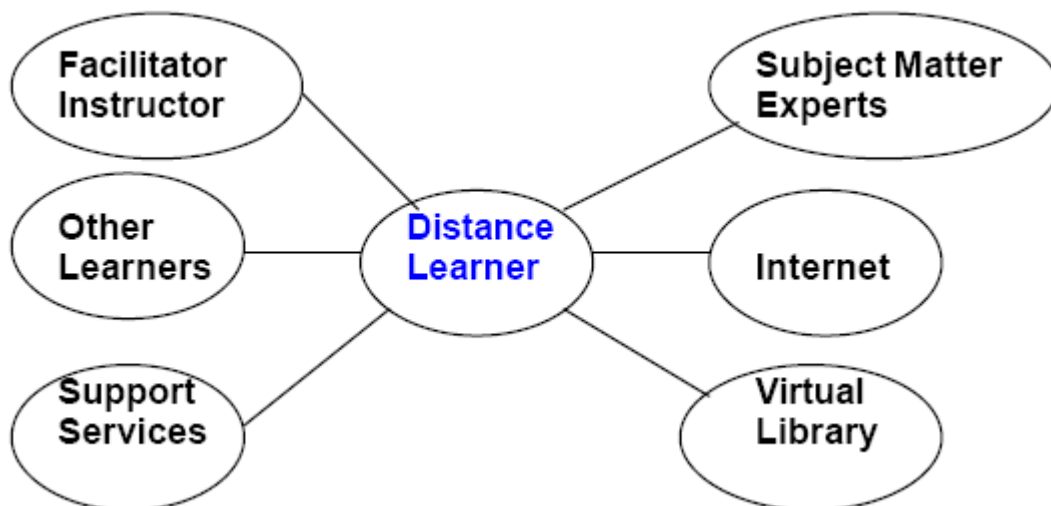


Figure 1: The Network Learning Environment (Chute et al., 1997)

There are various forms of networked learning environment; fundamental to all of them is the internet and WWW. Web enabled distance education or online learning is the planned learning that normally occurs in a different place from teaching and requires special design and instructional techniques,

methods of communication, organization and administration facilitated by the IT (Moore and Kearsley, 2005). Hybrid courses combine regular classroom meetings with instruction delivered at a distance (Ascough, 2002). This form of networked learning environment limits the number of face-to-face meetings (Walker 2004). There is also Web-enhanced instruction (WEI), or web assisted instruction (WAI) which refers to the combination of online activities with traditional classroom instruction whereby technology provides supports for communication and collaboration. In WEI or WAI, the numbers of face-to-face meetings are not reduced. The interest of this research is on WEI and WAI types of networked learning environment. There are many technology tools to support networked learning environment, however products like Blackboard and WebCT are very popular in higher education.

Factors affecting adoption and Utilization of Networked Learning Environment

Most studies on adoption and utilization of technology in higher education focus on instructional technology in general. There are some studies that specifically looked at the Internet and other related technology. Adoption and utilization of technology is a well researched area in information systems discipline, however most emphasis has been on business organization and business related technology. There are dearths of publications that specifically focus on NLE but some study generally looked at the adoption and utilization of instructional technology (Johnson, 2003; Daugherty and Funke, 1998; Park, 2003; Gilbert and Kelly 2005)

Johnson (2003) discussed ten reasons why faculty fail when using Blackboard (a NLE). He argued that materials on Blackboard course management system are not simply a new format for instructor led or self paced lesson, a well designed Blackboard training takes new or existing content and uses the power of NLE to increase student learning and experience. He discussed lack of well designed materials, materials do not facilitate learning, skipping of design process, lack of needs assessment, instructors who do not address the variety of purposes, financial and resource limitations, technical limitations, organizational considerations, lack of consideration for interactivity, and lack of consideration for instructor's role as the main reasons why faculty may fail in NLE.

Park (2003) surveyed 197 faculty on adoption and utilization of web-assisted instruction in higher education. He found that the level of WAI use is significantly affected by relative advantage, self efficacy, subjective norm, complexity and computer experience. His findings indicate that support(s) and time do not have any statistically significant effect on level of use. Similar findings have been reported by Daugherty and Funke (1998). Their survey focused on instructors and the most frequent barriers to using technology in the classroom. They found lack of technical support, adequate software and equipment, administrative support, preparation time to create assignments, learner resistance and their lack of technical knowledge as major factors. In order to increase the use of WAI, Park (2003) recommends that instructional designers and change agents like policy makers and educational administrators should pay special attention to relative advantage and complexity being important factors for faculty members WAI use. Similar results were also found by other researchers.

In another study on a faculty's intention to use web enhanced instructional components, Walker (2004) used an online survey to study 143 instructors from a regionally accredited associate's degree granting college with 11 campuses in the Western United States. These instructors use Blackboard courseware tools for web-enhanced instruction (WEI) in traditional classrooms. The study established a correlation between usefulness factors, ease of use, benefit to students and intended usage of WEI. He also considered some external factors like computer background and organization support. A very

weak correlation was found between computer background and perceived usefulness and there was no correlation between computer background and perceived ease of use. He attributes the relationship between computer background and perceived ease of use and perceived usefulness to the instructor's level of computer experience. Walker (2004) approached organizational support from management and end users' perspectives; he found relationship between management support and perceived ease of use and perceived usefulness. He however found no correlation between end user support and perceived usefulness and perceived ease of use.

Many other barriers to using instructional technology have been identified. Among the main barriers include lack of institutional or departmental funding, lack of time to learn technologies, classroom infrastructure, adequate computer hardware/connectivity, institutional incentives, knowledge about applying technology in teaching, access to software tools, central or departmental training and support, and information about available technology (Anderson, Varnhagen and Campbell, 1998; Gueldenzoph, Guidera, Whipple, Mertler, & Dutton, 1999; Groves and Zemel (2000); Beggs 2000).

Most of the studies that identified these factors are surveys that use TRA, TPB, TAM, and diffusion of innovation as the main theory and model. Some studies, especially in information systems use modified version of these models (e.g. Wu and Wang, 2005) but most importantly, the findings are not usually significantly different and only confirm the relevancy of using these model in testing adoption and utilization. The main concern of this study is to investigate some of these factors that have been identified in previous studies and examine any new factors that may be specific to the environment at sub Saharan Africa where the study will be conducted. Most of the studies rely on Rogers (1995) diffusion of innovation (DOI) theory, theory of planned behavior (TPB) model (Ajzen, 1991) and technology acceptance model (TAM) (Davis, 1989). These models and theories are reviewed below.

Diffusion of innovations theory

Diffusion of innovations theory postulate that diffusion of innovation (e.g. networked learning environment) occur as potential users (e.g. faculty members) become aware of the innovation, judge its relative value and make a decision based on their judgment, implement or reject the innovation, and seek confirmation of the adoption or rejection decision (Roger, 1995). These processes take place through a channel over a period of time among people (users) within a social system. Diffusion of innovation recognizes individual as well as social factors that can influence the decision to adopt or reject a given innovation. Rogers concludes that diffusion of innovation could be affected by psychological and behavioral as well as external and environmental factors. He identifies factors like perceived characteristics of the innovation and the type of individual decision involved in the adoption process, size of the organization and socio economic status of the users of the innovation.

Theory of planned behavior

Theory of planned behavior (TPB) is derived from theory of reasoned action (TRA) (Fishbein and Ajzen, 1975). TRA proposed that an individual's behavioral intentions depend on attitude and social norms and that these intentions resultantly affect individual's behavior. While TRA explains deliberation intention behavior (Ajzen, 1988), it lacks individual behavioral control. TPB encompass the construct of TRA and add perceived behavioral control which refers to an individual's perceptions and assessment of one's own capabilities and resources required to perform a behavior (Ajzen, 1991).

Technology acceptance model

Davis (1989) refines and extends TPB to propose technology acceptance model (TAM) which specifically tends to explain technology usage behavior. (Figure 2) TAM has been widely used in studies that measure, predict and explain the acceptance of information technology by users in various organizations (Chau, 2001). TAM affirms that intention to use a technology (user's acceptance) is affected by attitude toward using the particular technology to perform certain behavior and also by perception of the usefulness of the tool. Thus, attitude can be determined by perceived usefulness and perceived ease of use. External factors like social norms and control beliefs in addition to environmental factors like computer experience, computer phobia, computer self efficacy, supports are mediated by perceived ease of use and perceived usefulness. Davis (1989) defined perceived ease of use as the degree to which a person believes that using a particular system would be free from efforts and perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance.

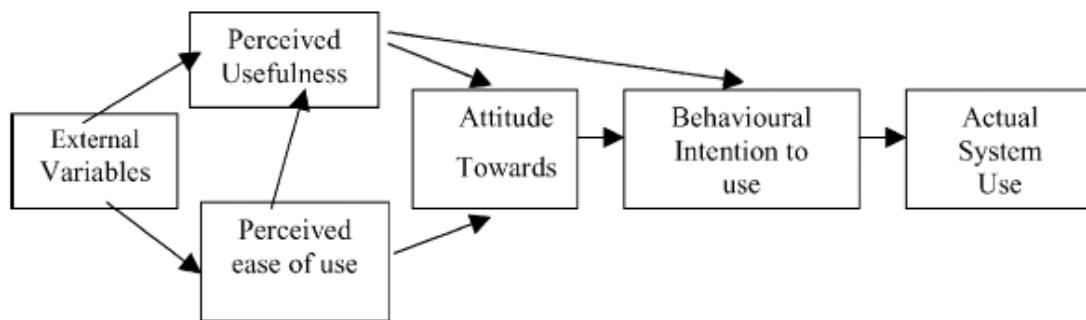


Figure 2: Original Technology Acceptance Model (TAM), Davies (1989)

Synthesizing DOI, TPB and TAM suggests that adoption and utilization of innovations could be affected by tapestry of many factors that includes perceived characteristics of technology, individual characteristics of adopters, social-economics factors, subjective norm, attitude, perceived behavioral control, perceived ease of use and perceived usefulness. In this study, all these factors shall be examined holistically to determine the significance of their influence on the adoption and utilization of networked learning environment by faculty in higher education.

Methodology

Settings and Population

This study will survey faculty at all higher education institutions in English speaking West African countries during the year 2009. The list of the institutions will be obtained from the ministry of education or similar authority in each country. The list of faculty and their addresses will then be obtained from registrar or appropriate authority in the university. There are five English speaking countries in West Africa – Nigeria, Ghana, Liberia, Sierra Leone and The Gambia. The total population of faculty in the universities in these five countries is representative of all faculty in higher education in sub Saharan Africa, considering the total national population. The study assumes close cultural proximity among these countries and comparable higher education funding.

Data Collection

Similar to most studies that utilize TAM, the hypothesis will be tested in a field setting using quantitative survey. The survey will examine relationship between external variables (age, computer experience), perceived usefulness, perceived ease of use, intention to use (adoption) and actual use (utilization). Survey questionnaire will be sent to all faculty, although participation is voluntary and anonymous. Data will be collected during the year 2008/2009 using online and paper-based questionnaire. Email will be sent to the entire faculty with a link to the questionnaire (where applicable). All required permission will be requested before the commencement of the study. The questionnaire to be used for this study will be based on the combination of TAM instruments from previous studies (e.g Davis, 1989; Landry, 2003; Igbaria et al., 1995; Burton-Jones and Hubona, 2005). There may be additional items that directly relate to the context of sub Saharan Africa. The original TAM instrument (Davis 1989, 1993) has 10-items each to measure perceived ease of use and perceived usefulness. Some studies have reduced the item but this study will use all the items to ensure maximum content validity (Burton-Jones and Hubona, 2005).

A five point Likert scale will be used for all items on the questionnaire. The responses will range from strongly agree, agree, neutral, disagree and strongly disagree. Since the instrument is based on previous research, it has been adequately tested for reliability, content and constructs validity. Content validity measures the extent to which the assumptions that result from the measurement accurately reflect the content the instrument purport to measure while construct validity measures the extent to which assumptions that result from the measurement instrument accurately reflect the construct the instrument claimed to measure. Reliability of a survey instrument refers to the amount of measurement error in the results yielded by the survey (Gall, Borg, and Gall, 1996).

Data Compilation and Analysis

Data will be extracted from the online database and added to the captured paper –based data. The merged data will be prepared for analysis. The demographic data will be analyzed using measure of central tendency while Pearson’s correlation coefficient will be used to measure the relationship between the constructs. Since the study is interested in the most important factors that influence adoption and utilization, regression analysis will be used to determine these factors. Microsoft Excel will be the primary tool for the analysis and if required, an advanced statistical package like SAS, SPSS could also be used.

Summary

The main interest of this study is to investigate the factors that influence the faculty adoption and utilizations of networked learning environment in higher education in sub Saharan Africa. The target population is the higher education institutions and faculty in sub Saharan Africa. Different kinds of Networked Learning Environment tools shall also be examined. The questionnaire to be used for the survey will collect demographic data about the age, computer experience and technology support and other details. The data collected will be used to determine how these variables affect perceived ease of use and perceived usefulness of the NLE. Perceived ease of use and perceived usefulness will be used to determine adoption and utilization. The data from private institution will be compared with the public institutions to investigate a largely ignored factor in adoption and utilization research.

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ICT and Construction: where are we?

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ABSTRACT

Currently information and communication technology is used extensively in most industries. The construction industry, however, is lagging in adopting and using information communication technology. Buildings, and the construction thereof, is a very old discipline, going back many centuries, yet the industry is slow in adopting these technologies. Construction informatics is also a relatively young and immature field of applied science and not well-defined. This paper investigated the reported research as published in journals and presents a classification of research themes on construction informatics. A classification of the themes is presented, indicating the main focus of each theme.

Keywords: information communication technology, construction industry

1. Introduction

The use of information and communication technology (ICT) in the wider construction industry, defined as architecture, construction and engineering, was measured in various countries since 1998. Studies were undertaken in Scandinavia, Nigeria, Jordan, Brazilia, Singapore, Malaysia and Canada (Howard, Kiviniemi & Olle, 1998; Lim, Rashid, Ang Wong & Wong, 2002; Samuelson, 2002; Oladapo, 2007; Rivard, 2000; Rivard, Froese, Waugh, El-Diraby, Mora, Torres, Gill & O'Reilly, 2004; Goh, 2005; El-Mashaleh, 2007; Scheer, Leusin de Amorim, Santos, Ferreira & Caron, 2007; Samuelson, 2008). Results from these studies show that general office administration software, including word-processors and spreadsheets, are commonly used in the industry. Software dealing with business administration, such as accounting and invoicing, is also used by companies as part of normal business practices.

The widespread use of application software packages in an industry however is not an indication of how well that industry is using information communication technology. The effective use of information and communication technology in the industry can aid in the sharing and delivering of information to and among stakeholders in the construction industry. Information sharing among the different stakeholders on a construction project is important for the success of a project. The nature of the construction industry is such that information is shared not only inside a company by the different processes, business and technical, but also with stakeholders outside the construction company, such as engineers, architects, clients and suppliers.

This paper presents findings of an investigation into the current research themes as published in journals. A classification of the themes is presented. A classification of current research themes is also presented.

2. INDUSTRY BACKGROUND

Gyampoh-Vydogah and Moreton (2003:168-169) found that problems with information management in construction can be divided into five categories:

- The inability of companies to develop an information management policy
- Cultural issues and barriers to the adoption of information technology
- Slow and labour intensive information management processes
- The inability to utilize the opportunities that information technology can present with business
- An unwillingness to use for instance available collaboration software, even though communication problems are often blamed for misunderstandings and delays on projects.

The management of the construction process involves a variety of stakeholders that are involved in the construction of a building. The various activities that take place on a construction site are part of the processes, and information is necessary to link all process and stakeholders together. Not only are the construction orders diverse, but the construction process is technology based (Jaafari, 2000:47). Information technology can play an important role in the management of processes, but the majority of construction companies associate information technology with word processing, spreadsheets, simple database applications and email. The sharing of information in a real-time environment can be achieved by the use of information technology, but is sadly not being utilized by the construction industry (Jaafari, 2000:51).

Collaboration between all role players during construction is not only important but also necessary for the successful completion of a project. Within any organization there exist a set of relationships that has an effect on how successful information sharing is among interested parties. The owner, general contractor, subcontractor, engineer and supplier are the major participants in a construction project. With so many interested parties, communication and information sharing among them is vital. Not only must the formal structures and networks be examined to understand the level of information sharing that is happening on a formal basis, but the informal relationships among parties will depend on how and when information is shared (Perreira & Soares, 2007:87). The various roles that participants can play vary with each project. The contractor, for instance, can also be the owner or the architect (Lockey *et al.*, 2002:235).

During the construction process the emphasis is on monitoring where actual performance is compared with planned performance, and controlling where actions is taken to correct deficiencies on all activities on the construction site. Typical activities include updating of the schedules or program, cost control, procurement, quality management, safety management, resource management, materials management and equipment management. Documentation and communication on the progress of all the activities involve create great amounts of paperwork. Documentation, according to Bennett (2003:205-256) includes:

- Submittals –extensions to the existing drawings and specifications as submitted by subcontractors, suppliers and the contractor itself. The contractor is responsible for managing the submittal process

- Variations - changes in the work that was tendered on. Unless a written variation of the work is received, contractors can normally not claim for work done that is a variation from the original plan
- Measurement, progress payments and retention – the contractor can receive partial payments for work completed
- Other project documentation and document management – this will include contracts, drawings, specifications, subcontracts, communication records (i.e. minutes of meetings), project status documentation, correspondence, materials management (i.e. purchases, inventory control) and financial documentation.

Modern companies will use information systems or software such as accounting systems, project management systems and communication tools such as Internet and email. Many such applications already exist and can be bought as complete solutions. There need to be an alignment between information systems in use and the organization. If not, it can have a detrimental effect on the performance of the organization (Hicks, 2007:234).

3. WHY DO THE RESEARCH?

An attempt was made by Turk (2006:195-196) to not only define construction informatics but also to create an ontology of construction research. He stated that core themes in construction informatics research are the creation of knowledge and support areas. The support of human activities in the construction business is the main focus of construction informatics. Information is created, edited, recorded and distributed by business processes. The challenge would be to manage this in such a way that it unlocks the knowledge and advantage that information can give to a company.

Research done by Turk (2007:215-218) on current and future research in the European community found that the six highest ranked current themes in construction informatics include collaboration infrastructures, software interoperability, e-business infrastructures, database information retrievals, business process re-engineering and knowledge management. From the same study, future research themes were identified as collaboration infrastructures, knowledge management, software interoperability, database information retrieval, knowledge intensive applications and human computer interaction. It is interesting to note that collaboration is rated the most important in current as well as in future research. Research in knowledge management is also regarded as important for future research.

Working commission 78 (W78) of the International Council for Innovation and Construction (CIB) found in 2002 that major themes in construction research is the modeling of processes and products, issues associated with technology and re-engineering of processes were the main themes of research papers published as proceedings. The majority of papers were from Europe. Less than 3% of contributions were from Africa (Amor *et al.*, 2002: 245-257).

Turk (2006:198) stated that “Construction informatics is a relatively young and immature field of applied science”. Buildings and the construction of it is a very old discipline, going back many centuries, yet the industry is lagging behind in the information and communications technology area.

It is therefore clear that further research into how information and communication technology can be used in the construction industry is necessary.

RESEARCH DESIGN

Papers published from the year 2003 to 2007 were analyzed to determine what the state of the research is: particularly, to discover which research was done in Africa as the author felt that challenges facing the use of information and communication technology in Africa is different from continents such as Europe and Northern America. Papers published before the year 2003 were excluded as the technologies, infrastructures and attitudes of people have changed significantly in recent years. Papers dealing with computer aided design, virtual reality and physical construction were excluded from the study as the author was only interested in the effect of information technology on business processes in the industry.

The two main journals analyzed were *Automation in Construction*, and *Journal of Information Technology in Construction*. These journals focus on the use of information technology in the construction industry. Other journals analyzed include *Engineering, Construction and Architectural Management*, *Supply Chain Management: an International Journal*, and *Construction Innovation: Information, Process, Management*. These journals do not focus on information and communication technology specifically but do contribute at times to the research pool in the construction industry. It was found that the number of articles published on the topic was low and hence no data from these were included in the final analysis.

The focus of the articles selected was on the management of a construction site where information and communication technology could potentially assist during the physical construction processes.

DISCUSSION OF RESULTS

A total of 99 articles were found that was used for the analysis. From the *Journal of Information Technology in Construction* 53 articles fitted the criteria and 46 from *Automation in Construction*. Figure 1 gives a breakdown per continent of which continents produced the most articles. The category labeled Collaborations is used whenever researchers from more than one continent collaborated in publishing their research.

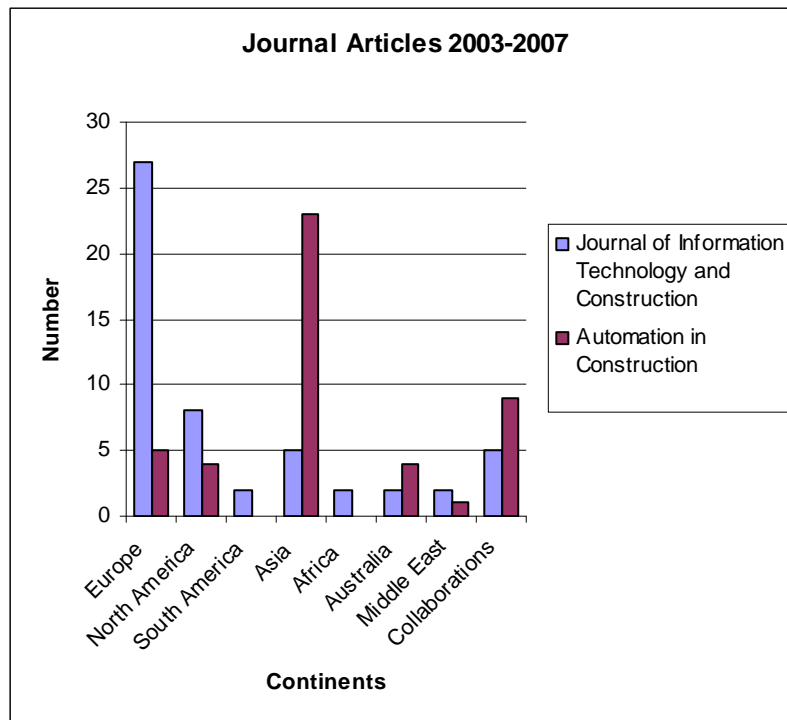


Figure 1 – Number of articles published per continent

Europe and Asia are very active in this research area with Africa producing only two research papers, both from Nigeria. From the publications it is clear that ICT in the construction discipline in Africa need more focus as a research area. The people, infrastructure and construction conditions are different from the other continents.

Published research papers were inspected and grouped per topic. Topics were selected according to the research content of each article. Figure 2 depicts the results of these groupings. From the graph e-commerce, adoption of information technology by the industry, planning, knowledge management and collaboration were the most researched topics. The research papers from Africa discussed the adoption of information technology in Nigeria.

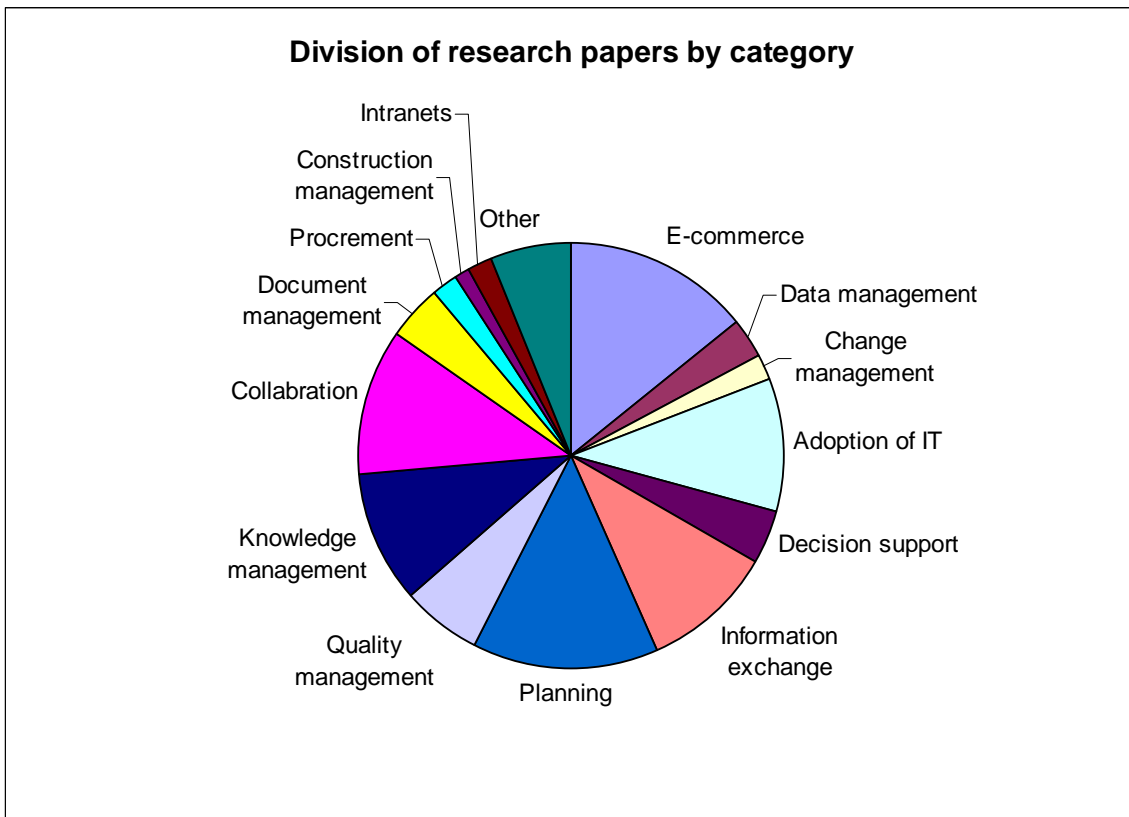


Figure 2 – Journal articles by category

CONCLUSION

No industry can survive without the use of information and communication technology (ICT). The use of ICT in the construction area however is limited.

The published research from Africa is low. Africa needs to solve its own unique problems with research focusing on Africa specifically. As part of a further qualification, a new area will be researched at the Cape Peninsula University of Technology in South Africa. This research will focus on the information usage within the construction industry, and the sharing of information between the sub-contractor and principal contractor. Business processes will be analyzed and a model of how information is used will be created. Central to this will be the role of ICT in all the processes and how ICT can benefit the industry as a whole.

Questions such as what information is generated/needed by business processes, the role of company organization on information sharing and the benefits of better information sharing will be verified by this research.

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The Use of Mobile Telephones as a Tool to Capture Statistical Data in the Educational Sector

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Abstract

This research-in-progress paper concerns research about EMIS (Education Management Information Systems). This is a computerised system for management and administration of the education sector. A problem for the system is the collection of data because many districts are not well computerized. The aim of the research is to propose remedies to this based on mobile telephone technology, especially text messaging (SMS), for data collection and direct inputting to the EMIS in Tanzania. A pre-study was conducted 2007 to collect data about the existing information flow as regards statistical data within the education sector and to identify bottle necks including both infrastructural and motivational obstacles. An in-depth survey is planned for 2008 to give further details concerning the prerequisites to connecting EMIS to the fast growing mobile technology network. The survey will result in a proposal for a definition of high priority data, data logistics, and a technologically diversified EMIS.

Introduction

The general applicability of ICT (Information and Communication Technology) is now acknowledged everywhere. ICT includes a range of technologies such as computers and Internet as well as radios and mobile telephony. ICT also includes the equipment and services associated with these technologies. In the context of the Millennium Development Goals, primary education has been the first target for initiatives and ICT can bring improvements in the education sector in many different ways. The Tanzanian Ministry of Education and Vocational Training (MoEVT) concludes that successful management and administration of education systems also require effective use of ICT tools (Education Sector Development Programme, 2004).

EMIS (Education Management Information Systems), a computerised system for management and administration of the Tanzanian education, is now implemented for collecting, processing, utilising and disseminating information (ICT Policy for Basic Education, 2007).

The document 'ICT Policy for Basic Education' (MoEVT) mentions mobile technology as a part of ICT in education. It also states that MoEVT "will ensure that all educational institutions are linked together in a secure network for administrative purposes (e.g. EMIS) with access to the Internet for teaching and learning and professional development" (Statement No. 6.4.5.). However, what our

research will focus on is complementary network for digitised administrative information flows, namely the mobile network.

Focus for ICT in development has traditionally been on increasing access of people to computers and to fixed-line telephones. The explosive growth of mobile telephony in many developing countries makes this tool worth to consider also where computers have been the traditional focus. Mobile phones are now the primary form of telecommunication in developing countries and they play the same role as fixed-line phone networks did in Europe and North America in the 20th century. (Mendes et al., 2007) Mobile telephony, and especially mobile applications, will transform the society.

Our research will focus on an application called Short Message Service (SMS) or text messaging. It permits the sending of messages between mobile phones and – with the right hardware and software equipment – other devices such as computers. SMS can also be used to interact with automated systems for services and for accessing information. Arguments in favour of SMS can be found in terms of its cost, speed, and accuracy. (Traxler 2006, 2007)

The fact that so many rural schools in developing countries lack access to computers, coupled with the dramatic growth of mobile phone access through most of the developing world, provides an opportunity for the use of mobile technology in EMIS.

Research problem

A problem for the EMIS system is the collection of data: many districts are not well computerized.

Attitudes among teachers in rural primary schools to acceptance and usage of mobiles in EMIS

Research questions

Tentative survey questions:

- Attitudes among administrators on different levels to mobiles in EMIS
- Mapping of mobile phone ownership, usage and access among teachers in rural primary schools
- Mapping of mobile phone
 - networks (companies, coverage, tariffs, GPRS, GSM)
 - regulatory and licensing system
- Mapping of information flow in education administration
 - administration of primary education

Objectives

The aim of this study is to give a picture of the present system i.e. an analysis of the information flow on statistical data within EMIS and to propose an alternative to the computerised EMIS, namely one based on mobile telephone technology, especially text messaging (SMS), for data collection and direct inputting to the EMIS in Tanzania.

The overall aim of this research is to architect a proposal for a 'blended' EMIS consisting of main frames, Internet connections, PCs, mobile phones, and SMS servers. The proposal will consider how and who designs SMS forms, content focus, frequency, feedback loops.

Analysis of the condition for the use of mobile telephones in the educational sector

Literature review

The mobile phone growth has been enormous. Fifty per cent of the 6.5 billion people in the world can now use a mobile. In addition, there are at least twice as many mobile owners in developing countries as in industrialised countries. (Donner, 2006; Heeks & Jagun, 2007) “Subscriber growth rates in developing countries are 25 percent per year – and double that in Africa” (Heeks & Jagun, 2007).

The costs of mobile telephony have dropped steadily, coverage has expanded, and mobile phone subscriptions in developing countries have increased by over 500 per cent since 2000 according to a recent study by Gillet (2007).

Mobile networks covered 80 per cent of the world population at the end of 2006, up from 40 per cent in 2000. The prognosis is that by 2010, 90 per cent of the world will be covered by mobile networks and that mobile communication will deliver voice, data, and internet services to four billion by 2010 and to more than five billion people by 2015 – double the number connected today (GSM Association, 2007). The rise is partly made possible by the development of low-cost handsets to meet the demand from new subscribers with small income (PC World, 2006). In fact, in the near future, more than half the mobiles in the world will be in the developing world according to a prognosis made by Donner (2006). The availability of cheap handsets is likely to fuel the expansion of SMS text messaging. The largest operator in East Africa (Kenya, Tanzania and Uganda), Celtel, charges approximately US\$ 0.212 for one minute of voice time compared with US\$ 0.036 for an SMS (Mendes et al, 2007). These pricing conditions have helped foster a culture of SMS in much of Africa.

The tables below, taken from a June issue of *Wireless Intelligence*, show the absolute number of connections and mobile density in Africa as a whole as well as in East Africa. In Tanzania, the growth of mobile telephony has been almost 1600 per cent between 2002 and 2008.

Number of mobile connections in Africa and East Africa, 2002-2008 (1000s)
(Wireless Intelligence 11.06.2007)

Market	Q1 2002	Q1 2003	Q1 2004	Q1 2005	Q1 2006	Q1 2007	Q1 2008F
<u>Africa</u>	28,029,203	39,707,215	57,506,325	90,629,595	145,525,786	210,653,790	259,872,309
<u>Kenya</u>	625,604	1,200,682	2,154,596	3,740,970	5,526,018	8,366,857	10,130,228
<u>Tanzania</u>	455,845	854,010	1,303,765	2,252,500	3,874,175	6,223,585	8,213,914
<u>Uganda</u>	336,543	539,489	758,198	1,242,806	1,935,817	3,054,179	4,073,254

Mobile market penetration in selected African countries, 2002 – 2008
(Wireless Intelligence 11.06.2007)

Market	Q1 2002	Q1 2003	Q1 2004	Q1 2005	Q1 2006	Q1 2007	Q1 2008
<u>Africa</u>	3.4%	4.8%	6.7%	10.4%	16.3%	23.1%	27.9%
<u>Kenya</u>	2.0%	3.8%	6.7%	11.5%	16.8%	25.1%	30.0%

Tanzania	1.3%	2.3%	3.5%	6.0%	10.1%	15.9%	20.6%
Uganda	1.4%	2.1%	2.9%	4.6%	6.9%	10.6%	13.6%

A study from Kenya shows that teachers can be classified as “early adopters” when it comes to using mobile phones for communications, information and, more recently, access to a range of services (Traxler, 2007).

Mobile phones have improved poor people’s situation in several ways, from providing political news and health care information in rural and remote areas to fuelling commerce (Huizinga 2008)

Because of its relatively low cost, ease of use, and accessibility mobile connectivity might be the solution for connectivity in rural areas in low-income countries – higher accessibility and decreased travelling. In many low-income countries the mobile platform and technology is currently the only option available for last mile access for the majority of communities. Mobile technology is considered a major opportunity for enhanced roll-out of ICT and a range of new applications to the poorest societies in Africa. There is a spreading recognition that mobile technology brings opportunities for increased efficiency, a more equitable and better diffused economic and societal progress, empowering local communities. To mention is a Uganda project which has developed an SMS application for a dairy farming cooperative in a rural setting as well as the back-end linkages that will be the source of the data. In this project mobile phones provides last mile input of data and access to information which will allow decisions to be based on current and accurate information. SMS can be used for farmers and fishermen to access market information without middlemen and without travelling long distances. (SPIDER 2006a; 2006b)

M-banking and m-transactions are two instruments to provide services to the low-income segment. To mention is the Philippines, the so-called SMS capital of the world, where such applications have been developed on a national level through collaboration between banks, mobile operators and legislators (SPIDER 2007a). The service enables any prepaid account holder to send and receive money, pay bills and taxes, and purchase item through SMS (SPIDER 2007b).

Methodologies

This research will apply the Critical Realism (CR) approach, a methodological approach that claims that social reality is not composed of agents’ meanings but that there exists structural factors influencing agents lived experiences (Carlsson, 2003). CR starts from an ontology which identifies structures and mechanism through which events and discourses are generated as being fundamental to the constitution of our natural and social reality (Carlsson, 2003). Further, CR recognises the reality of the natural order and the events and discourses of the social world. A main thought is that “we will only be able to understand – and so change – the social world if we identify the structures at work that generate those events and discourses. These structures are not spontaneously apparent in the observable pattern of events; they can only be identified through the practical and theoretical work of the social sciences” (Bhaskar, 1989, as cited in Carlsson, 2003).

A prestudy was conducted 2007 to explore the existing information flow as regards statistical data within the education sector and to identify bottle necks including both infrastructural and motivation obstacles. The prestudy includes interviews with administrators and managers of EMIS. The analysis of the prestudy will include identifying underlying structural factors.

Based on the pre-study, an in-depth survey, planned for 2008, will be designed to give further details concerning the prerequisites to connecting EMIS to the fast growing mobile technology network. An in-depth analysis will be conducted and result in a proposal for a definition of high priority data, data logistics, and a technologically diversified EMIS. As concerns the data categories, one may venture to think that not only pupil enrolment figures are of interest but also up to date information on food supply and also equipment standard such as computers, Internet connection, and electricity. As concerns data logistics, one may venture to think that collection of data can be distributed over the year in a more efficient form if small but repeated collections via SMS can be conducted. The survey includes questionnaires to DEO and local administrators as well as questionnaires to head teachers at primary schools.

The research data will be analysed using a system theoretical approach as well as the ‘Sustainability ICT Framework’ developed by Sundén and Wicander (2002, 2003, 2006; Wicander & Sundén 2004; Wicander forthcoming).

Research beneficiaries

Different groups related to the educational sector will in the long run benefit from the existence of reliable statistical data about individual schools and the sector as a whole. Beneficiaries to mention are the Ministry of Education and Vocational Training, donors as well as schools, teachers, and pupils.

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Exploring Information Technology for Palliative Care in Developing Countries: Lessons from American Medical Center using Footprints

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Abstract

Issues related to healthcare continue to be of paramount importance in America today. It is one of the highly debated public policy issues of our time. With an annual expenditure that already exceeds \$1.7 billion, while yielding less than optimal results, it stands to reason that we must turn to promising tools and solutions, such as information technology (IT), to improve service efficiency and quality of care.

In 2004 the U.S. government laid out an agenda, framework, and timeline for national health information technology development. Given the initiatives made many years prior by other countries, the U.S. agenda was overdue, but crucial and imperative, considering the issues of high costs, medical errors, variable quality, administrative inefficiencies, and poor coordination. As reported by Kuziemsky and Jahnke in 2005, there are currently thousands of information systems in use in physician offices and hospitals across the U.S., but for various reasons, these systems' usage remains sub-optimal. Advancements in both medical technologies and information systems have not been capitalized upon; extending information systems usage beyond data collection to include administrative and decision support, care plan development, quality improvement, etc. in healthcare is essential and would help mitigate this incongruence. A study commissioned by RAND in 2005 also supports this view, and highlights several benefits, which include higher quality of care, financial savings, increased safety, etc. These and other benefits are where the true emphasis for IT integration in healthcare should be rooted. The central question is: "How can value be added to IT infrastructure that changes or impacts the quality of care for the better?" In this paper we focus on healthcare services for palliative patients. We present the development and preliminary accounts of a successful initiative in the Medical Center of Central Georgia where footprints information technology was developed and integrated into the center's palliative care system. The project provides evidence that there are a plethora of areas in healthcare in which innovative application of information systems could significantly enhance the care of loved ones, and improve the operations of the industry at the same time.

Key Words: Palliative care, Footprints Information Technology, Patient Tracking, Clinical Information, Communication Module, Electronic Medical Records.

Introduction: Palliative Care Summarized

Palliative medicine is one of the newest medical specialties, but its history is rich and long, rooted in hospice and the omnipresent care provider role observed toward the end of life. The World Health Organization (WHO) describes palliative care as:

“... an approach that improves quality of life of patients and their families facing the problems associated with life threatening illness, through the prevention of suffering by early identification and impeccable assessment and treatment of pain and other problems, physical, psychological and spiritual”

The motivation of those in the contemporary field of acute palliative care is to “offer a support system to help patients live as actively as possible until death, while helping the patients and families cope during the illness process” (Moreno, 2005). The intent is not to hasten or postpone death, but enhance and improve if possible the quality of life left through an integrated team approach. This interdisciplinary team usually involves members from the primary care setting, specialties, nursing, physical therapy, counselling/social work services, and pastoral care. The team focuses on the four quadrants or aspects of care that make up a “comprehensive” palliative care approach. The four aspects are represented in Figure 1 below.

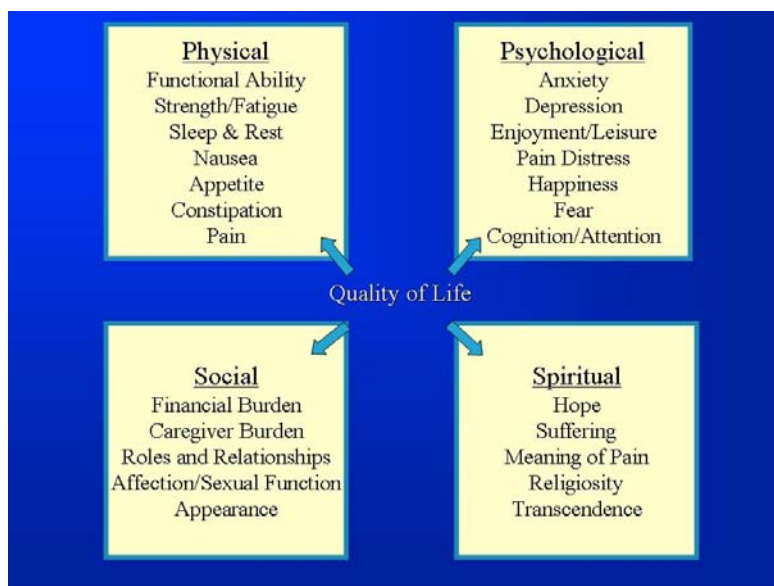


Figure 3: Quadrants of Comprehensive Palliative Care

One of the benefits of the comprehensive palliative care approach is that it has the potential to enhance the quality of life defined by the patient and could influence the course of the illness. The traditional approach to palliative care is depicted in Figure 2. In this approach, there is a clear demarcation relative to timeline as to when curative or life-prolonging treatment ends and palliative care is initiated towards the end of life (just prior to hospice care intervention). The modern approach shown in Figure 3 is preferred for obvious reasons. When applied early in the course of treatment, hope for a positive outcome can be complemented with educated objectivity; and that takes away the mystery of the progression of disease. We can prevent the progression of care represented below and introduce a new timeline of treatment, more patient centered and coordinated, with palliative care administered all along the way. This partnership allows for a dedicated healthcare team to become aware of the nuances of the family dynamics, coping skills, pain and symptom needs, as well as the treatment plans and options throughout the course of the illness.



Figure 4: Care Process with Separate Palliative Component



Figure 5: Comprehensive Care Process with Integrated Palliative Care

The case presented in this paper is based on the comprehensive palliative care approach. At the Medical Center of Central Georgia, we considered the needs of patients in the development of the new information system for palliative care; we migrated towards those classified as having the most complex care needs. This can be defined as those demonstrating complex physical, social, psychological and/or spiritual needs that do not respond to simple or established protocols of care. Additionally, they typically require highly individualized care plans. The development team considered all of the above issues and complexities in dealing with the collection of relevant patient information to be used in the coordination of care and communication between multiple stakeholders.

The Medical Center of central Georgia

The Medical Center of Central Georgia (MCCG) is an academic health center associated with a large health system including a mission of quality healthcare for the community. In response to a community need, and the foresight to see the value in palliative services over the next several decades for our aging population, the Medical Center opened its Center for Palliative Care (CPC) in 2003. Palliative care, the foundation behind hospice care, is approached differently in an acute care setting as the focus remains on the patient, not the disease, with providing maximum support through pain and symptom management, as well as psycho-social and spiritual support. This delivery setting is complicated when compared to a community setting due to multiple admissions and numerous healthcare providers involved in care.

MCCG quickly enveloped the mission of palliative care, as it expanded not only its clinical services, but established an integral connection to its other medical departments, like its community based hospice, outpatient indigent services, multiple residency programs while all the while merging with the already established community Transitions program. At its infancy, the acute palliative approach was only recognizable in the community program called Transitions functioning with the ICU's on loan from the home health/hospice division to provide a support and service coordination system for chronically ill patients dealing with complex clinical and psycho-social issues. When considering the development of a true inpatient *center* for palliative care, it was only natural to include the existing counselling services, as this was imperative in integrating the complete framework of palliative care with

inpatient patients and families coping with newly diagnosed conditions and complex medical needs.

Today, the palliative care service of the 603-bed facility is an active local and regional leader in the delivery of comprehensive clinical case management, palliative education, counselling, and grief services. The Center for Palliative care, over a period of four years, has grown from a two-person community social support program, into a 15-person proactive inpatient and community service integrating psychosocial and physical care. The development of an onsite integrated palliative care consult team (PCCT), staffed by mid-level providers and palliative care physicians, brings with it a new dimension of complexity, as these very differing disciplines must rely on portions of the others' patient records in their assessment of patient and the determination of a medical care plan. For this and other reasons, in the spring of 2006, management decided to develop a conceptual model for a department specific information system that would go beyond the data archiving being done in Microsoft Access and complement the existing Citrix EMR infrastructure. One of the authors of this paper and a select group of experts worked for several months on the conceptual development, drafting plans for integration and implementation of a new multi-agent system (MAS) information systems solution for the Center for Palliative Care.

We present an account of that process as well as some insight on preliminary results on use by various stakeholders. First, in order to understand the specific aspects of the system, it is important to know more about palliative medicine and the type of information necessary to provide "informed" and "comprehensive" care. Having this perspective allows us a jumping off point to consider additional features desired of the IS in place and the opportunities that the future holds for improving quality care.

Exploring IT to Enhance Palliative care

Moving beyond the traditional astounding technologies (e.g., automated ventilator, portable defibrillator, or nutrition substitutes, etc) associated with end-of-life care, there exists an ever-broadening opportunity for innovative utilization of information technology in healthcare. Administrators use patient scheduling systems; units use remote monitoring devices; IT, the patient representatives, social workers, and billing use the electronic medical record to access and input information. But beyond the traditional usage of IT, the Medical Center of Central Georgia was interested in Health Information Technology (HIT) for a

specialized and integrated approach to a unique service process, not easily addressable by “out-of-the-box” hospital information systems. It was felt that the development of a specific tool was warranted as the needs of those working in the field are distinctive. An exclusive system had to be established to address the spatial limitations of knowledge, allow for the retrieval of personalized queries, and coordinate tasks among autonomous entities, while allowing backdoor access to data that might later be used to decompose a complex problem. During the development process, considerable attention was given to issues such as security, usability, and adoptability.

Overview and Systems Development of Footprints System

The traditional significance of a new information system in healthcare would be to impact the process of care and service by introducing a component of either (1) standardization (2) real-time information (3) EHR integration all of which influence information collection or information access. In palliative medicine, we are interested in how this information may best be *used* to enhance quality patient support, not just stored or reviewed retrospectively. As such, we focus on the identification/assessment of patient needs within the four domains previously detailed. The patient’s families play a key role as well. Each is integral to the practical and emotional aspects of the care that the patient will receive (Rabow, Hauser, and Adams, 2004).

When all the aspects of palliative care service are considered, the Healthcare Information System (HIT) is the primary or focal point to begin the gathering of information that aids in the decision making and support process. For complex chronic diseases that involve multiple facilities, physicians, care-givers, locations, and records, it is widely accepted within the informatics circles that an electronic information system can only facilitate the disease management process. For our situation, we were determined to implement an information system that would help in various aspects of palliative care, including disease management.

We found a systems application produced by Numara® that was developed to help organizations track, manage, and resolve incidents. The communication aspects drew us to select it as the platform for the development of the database. Kuziemyk and Jahnke (2005) agree that “communication” is important and “crucial...because providing healthcare is a continuous act...and draws upon past care and impacts future care.” Furthermore, the National Framework and Preferred Practices for Palliative and Hospice Care Quality and

National Quality Forum Consensus Report (2007), places emphasis on formulation and dissemination of timely care plan and communication as a basic tenet of quality care delivery systems. This report further supports the need for healthcare technology indicating that advance directives and care goals be made available across care settings through electronic personal health records.

The IT department had recently developed and piloted a derivative of a complaint tracking system, with multi-user communication and notation support, and we thought that with some intense modification it could be retrofitted and tweaked to suit our needs.

We set out a course and established some objectives of the project, specific to our situation, early on. After some deliberations by the focus group, the following were developed to capture the essence of what we wanted to achieve.

1. Improve the process of collecting information from palliative patients, their families, and already contained but dispensable medical (clinical) information.
2. Improve the access to that information.
3. Enhance monitoring of patients' status through the continuum of care.
4. Eliminate duplication of services and expedite care.
5. Provide a platform for further application of intelligent data analysis and decision making through the information system.

In considering the needs of all potential users, we thought it was essential to get the inputs of valued stakeholders outside the key process or systems development group. Representative members from administrative, clinical, social service, and IT departments made up the primary group, but additional inputs were gathered from the other "potential" users of the system (e.g., secretaries, nurses, and counsellors).

We then decomposed the information types that were to be considered as unit, system, or individual inputs. They were: (1) the hospital log, making up the primary resource for clinical information, based on the hospital Citrix EMR system, (2) a department demographic and action log, which comprised of an old access dataset and handwritten daily notes, (3) the referral log, linked to the Citrix system and CPOE (computerized physician order entry) for prescriptions, tracking patient flow and service provided by the consult team, and (4) unique records, maintained in a hardcopy patient file, such as advance care planning documentation, photographs, or supplemental community case notes.

The IT team worked for several weeks, to develop a prototype that was eventually presented to the group for a first round of feedback and evaluation. From the start, we choose to

maintain, as our moniker (or nickname), the product name of *Footprints*, as it was a fitting and symbolic term applicable to the efforts being undertaken at the Center.

Footprints System Components and Model

General Patient Information: The Footprints system acts as a repository of department-specific patient information that is necessary and useful in the day-to-day operations of the palliative care unit and other hospital units, by the palliative care consult team (PCCT). The nature of the information is the key to interacting with the patient and in the development of the holistic care plan process. The system communicates with the hospital based EMR (electronic medical record) to port information and auto-fill fields, by means of a file information number (FIN). As depicted in Figure 4, this section is comprised of general demographic and historical assessments, which are information primarily provided by Citrix, but augmented with up-to-date family information and a detailed psycho-social assessment.

In this system, even the patient's address and that of the next-of-kin and "agents" are insightful beyond the traditional billing purpose. It provides details regarding their homestead environment; giving the case planners and community workers a starting point to consider social services and available homecare services, and when patients access the system at a time they are no longer able to communicate it provides the legal decision makers of care. Just the generic value in creating a family tree of contacts, is imperative in palliative medicine, because as illness progresses and death appears imminent, family members begin appearing out of nowhere demanding information on the status of their loved one. Due to HIPAA (Health Insurance Portability and Accountability Act) regulations, this information is privileged and maintained private, only releasable to those "identified" as family or approved agents of the patient. Footprints gives us the ability to connect people to patients and track via an interaction log, the communications with that individual in an effort to provide clear and consistent information about the patient through the interdisciplinary team approach.

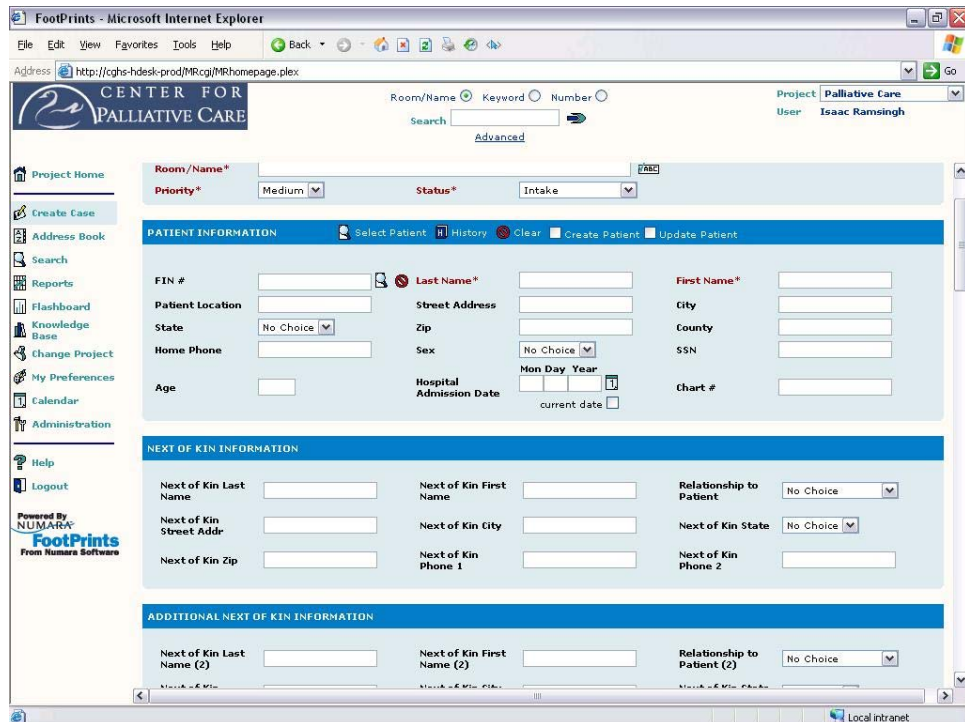


Figure 6: *Footprints* General Demographic Information Section

Patient Tracking: The next section in our integration of the footprints information systems in palliative care is captured in Figure 5. It provides the context for care and rationale for dedicated palliative services beyond those of a clinical nature. Referrals to a consult service can range in nature from a request from an ancillary team requiring specialized education on a clinical condition to either staff or to the family, to one requesting aid in a code status change or medical management of symptoms. The primary and most often referral reasons are listed in selection menu to the right. It should be noted that multiple reason for a consult can be chosen. After that is defined, we continue with information that aids in the place of the patient in the chain of care, such as addressing advance care planning and code status. Visits/interactions are tracked via a calendar function and the location of the patient is tracked to best manage the care process as someone during their stay may have a prolonged and multi unit visit or experience something as traumatic and difficult as illustrated in the following account. Upon entering and leaving the ER, a patient may need ICU care; and once stable is transferred to a floor. With time they are discharged to go home, but they may develop complications and return via the ER, and then to the ICU again, but with an infection,

whereupon the disease/illness becomes complex and irreversible in nature, needing palliative support in a dedicated unit. The patient expires, and lastly gets transported to the morgue.

Considering the scenario just given, it is important to know every aspect of the caregiver interaction in the context of which it happened. The referral may come from a location in which the expertise or life experiences of a staff member would be a valuable asset in communicating with a patient/patient family or in developing a care plan, like the epilepsy center (one staff member had personal history) with a traumatic brain injury (TBI). Other times the location information gives insight to the nature of the type of services being provided. The location may indicate that the support provided may only be for screening purposes in an outpatient setting, other times it may be a consult for aggressive pain and symptom management in the oncology department. Thus, those involved in the plan of care may be different for the same patient throughout the course of illness. Depending on the situation, the system may only need to alert counselling staff, or counselling staff with a clinical consult to follow, or alert a palliative care administrator to check availability of a bed in the unit due the urgent nature of the case. What is unique about palliative medicine is that several routes or plans or experiences may play out before a team member any day when provided the same blanked clinical information, but it is the interaction of that information with the psycho-social-spiritual aspects of life that differentiate chosen paths of care.

Figure 7: Footprints Case Information and Tracking Section

Clinical Information: This department-specific information component (shown in Figure 6) is different than that contained within the computerized physician order entry (CPOE) systems used for authorizing and dispensing medications and laboratory test authorization and tracking. It is also different than the electronic medical record (EMR) which is used for patient tracking, progress note-taking, billing, and aggregation of autonomous systems data. Pain and symptom management in palliative medicine can not be relegated to the comments sections in the physician’s notes. Pain and Symptoms are more important than that due to their crucial impact on quality patient outcomes. Pain is especially critical, because it normally escalates as palliative patients near end-of-life and may act as an indicator of the progression of the illness in a “patient-centered” context, since everyone deals with pain and often relates that information differently.

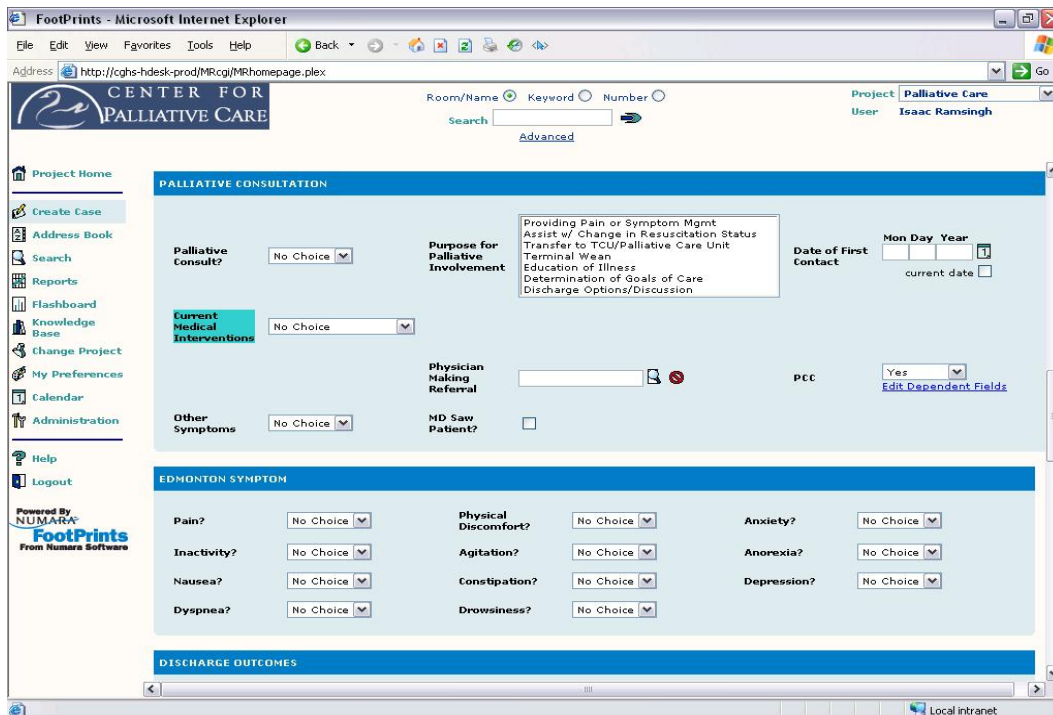


Figure 8: *Footprints* Case Consult Information Section

In much of his research on palliative care and possible application of IT/IS, Kuziemsky speaks directly to the importance of accurately tracking pain. Normally, pain does not stem from just one etiology (or cause). For example, the pain experienced in metastatic bone cancer may come from spiritual, psychological, anxiety, or distress (Kuziemsky and Jahnke, 2005). Because the clinical tracking of pain and other symptoms is crucial to this population, The National Quality Forum (2007) has mandated this be a routine and mandatory aspect of all palliative patient interactions.

As such, Kuziemsy and Jahnke (2005) suggest that in the development of a system, “a large number of data elements need to be considered” as these would aid in “determining what is the cause of patient’s pain and how to manage it.” When considering the types of pain, the context of that assessment is quite relevant. In Figure 7, we utilize the Edmonton’s Pain and Symptom scale to track pain longitudinally. This allows us to compare pain and symptom progression with specific instances of events or treatments, not in just the vacuum or raw numbers. We can tag the assessment with a date and time. One shortcoming of this widely adopted assessment tool is the self-reporting aspect of the scale. But at this time, it is the best and mostly widely-used assessment for pain and symptoms. A valuable tool in the arsenal of Footprints, discussed in more detail later, is the query and reporting function. Utilizing it to get patient-specific pain information, we are able to do several very interesting and valuable things, like generate a graphical representation or chart of the patients pain over time to show them and their families how the course of treatment is producing tangible results.

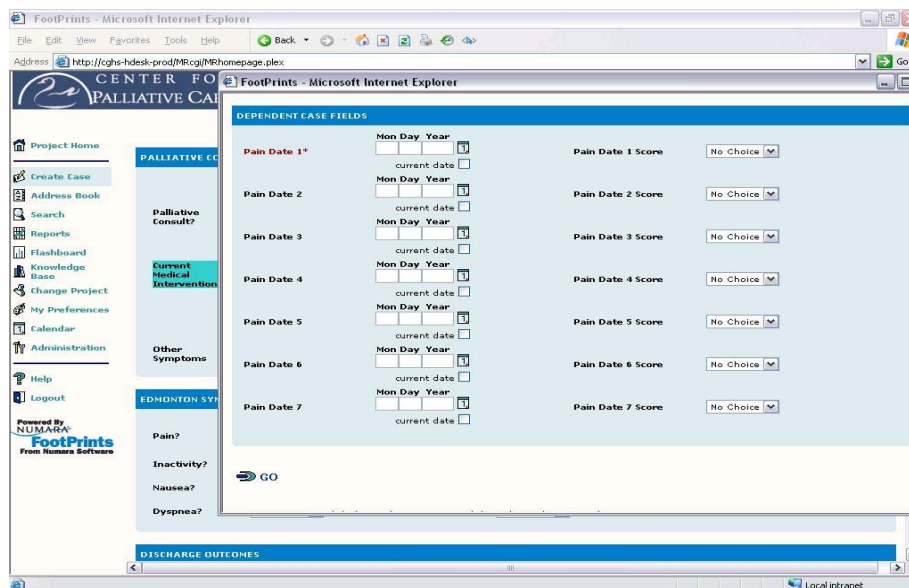


Figure 9: *Footprints* Edmonton’s Pain Scale Information Section

Communication Module: Communication support is an integral component of the system. Clear communication and the tools to aid in that goal are necessary in the effective and efficient provision of palliative care in an acute care setting. Hospitals have long used pages, cell phones, hip phones, unit’s dispatches, and tubes to relay information about the status of a patient as quickly as possible. One of the shortcomings of those systems is that once the

conversation or transmission is over there is rarely an account of that event, let alone a record of the information passed on. The footprints system has a multitude of features that greatly enhance palliative care. Due to space limitations, and in the interest of brevity, however, we will mention only a few in this paper.

The communication tool integrated into Footprints is shown in Figure 8. It allows us to not only keep track of external conversations with patients and families about the progression and process of care, but also provides a mechanism for intern communiqué that has the potential to be integrated with all the above mentioned systems, like phones, pages, and even email. The care-giver simply inserts notes directly into the system or imports via a WORD document (e.g., an externally created care plan) or can send the information to the system via email or SMS (Short Message Service) text from a phone.

Alerts for staff can be directed out from the system to the assigned individuals via email, phone, or page informing the staffer of a change in status of something they are interested in, say code status or arrival of a family member for a conference.

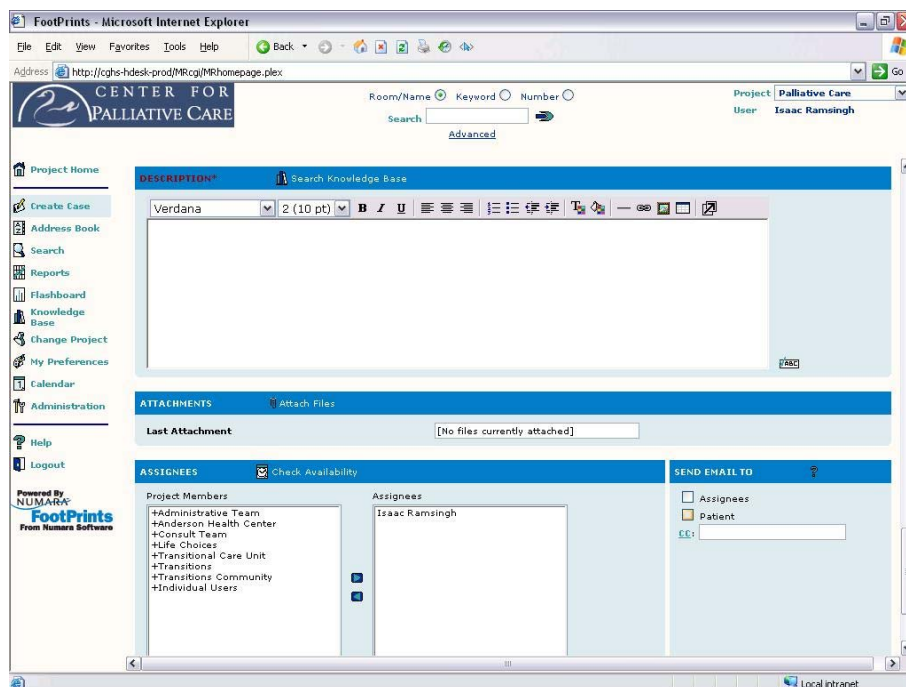


Figure 10: *Footprints* Communication and Assignment Section

Remote Access Feature: Another strong suit of the footprints system is the remote access feature. As we built upon the initial system, we integrated the service with internal Intranet and wireless system within the hospital. Furthermore, the firewall were modified to allow for remote desktop and email access into the system, although not allowing for export of information for security reasons. Adding these features increases the functionality of the service.

The Footprints system and Users: The footprints information system has already shown tremendous promise in the enhancement of palliative care. Currently, over twenty caregivers and administrators are using multiple aspects of *Footprints* in their daily work at the Medical Center of central Georgia (MCCG). The users range from physicians, nurses, counsellors, social workers, medical educators, clergy, administrators, student interns, hospice staff and secretaries. They continue to report that are finding the system to be extremely helpful and relevant to current care and to promote continuity between caregivers and settings. Since the rollout in fall of 2006, the unit has purchased 6 new wireless laptops for use around the facility and offsite in addition to the 8 office desktops within the CPC and the several dozen PC's available throughout the hospital.

Whether it is accessed from an office desktop, laptop, remote desktop, PDA, or cell phone, the clinical staff has the tools it needs to make an initial assessment, update a record, or just confirm patient information whenever they want. It effectively and effortlessly captures an enormous amount of data that was previously recorded in carbon copy in duplicate logs, one on the unit with the patient and one with the caseworker. Those days are now gone as the virtual environment allows for almost real-time updates and minimally delayed communication. A model of the system is shown below in Figure 9. It shows how the system is integrated into the hospital EMR, is accessible from multiple sources, and receives input from multiple places. The incorporation of this system allows the CPC team to improve upon its challenging work with patients and strive to provide the most comprehensive care available and use information that is patient-centric in the development of a specialized and holistic care plan for loved ones.

The *Footprints* model:

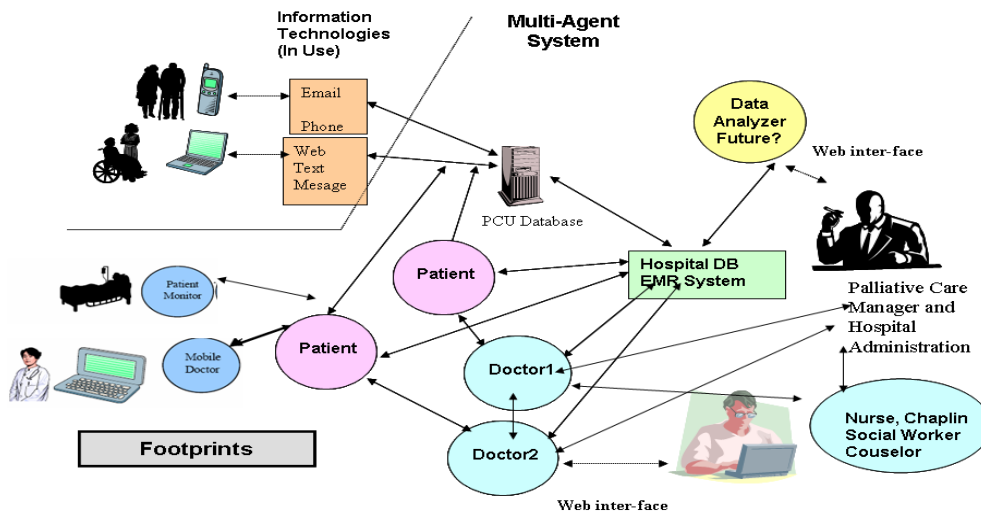


Figure 11: The *Footprints* System Model

Extending Footprints and Related Research into the Future

Research shows that not only is our population aging, but that the progression of chronic illness is becoming more complex as co-morbidities increase in our aged. This is further complicated by the nature of American healthcare working on a organ by organ approach rather than a holistic emphasis found in the Palliative model. Those receiving care are today are at more risk than ever to receive inadequate treatment, experience fragmented care, and receive poor information (Meier, 2007). She contends evolution of palliative care programs will come not from an altruistic motivation like MCCG was drawn, but more out of “necessity.” As such we believe that it is the duty of hospital administrations to continue to look forward and adapt as technology around us adapts. The horizon is in front of us, and always will be, as with time there is no end in sight. So in order to provide the “best care” possible for those at end of life, in addition to mechanistic technology to lengths life, we must provide the most up to date technology to those providing and “deciding” that care and treatment.

We plan to extend this “patient-centric care” research on integrating the footprints information systems in palliative care and palliative medicine beyond the planning process and development of a care plan. Consideration for the adaptations to the existing information system would have as a requirement, standards and components necessary to a care plan and be able to reduce gaps of information that would be essential to the plan development. We passionately believe the future holds promise for a full and integrated HIT network at the Medical Center of Central Georgia. By incorporating the existing electronic health record, computerized physician order entry system, the Footprints Palliative Care information system, and a yet to be developed decision support scheme, the hospital is poised to corner the local market in end-of-life care support infrastructure. This could happen by utilizing the continuum/spectrum of care options/services that MCCG offers, while blending the on-hand patient information and communication systems.

We also plan to extend the footprints system to healthcare domains that are beyond palliative care, but beneficial to the community that we serve. Farther down the horizon we will

explore the application of another information technology to mitigate disparity in access to healthcare by many of our citizens. We are very optimistic that the research efforts and investments that have been made in the current project are *footprints* to guide us into the future.

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Critical Pathways and IT: Barriers to Physician Adoption of Technology in Developed and Developing Countries

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Abstract

Variance in patient treatment in healthcare is leading to spiraling healthcare costs, increases in medical and medication errors, and a downward turn away from patient-centered care. In the U.S., critical pathways and a multi-disciplinary team approach which manages the needs of the total patient are being adopted by benchmark hospitals nationwide. Could critical pathways approach be viable in Africa and other developing regions? What are some additional barriers that need to be overcome? Are there some factors peculiar to Africa that would facilitate the adoption of critical pathways? These are some of the issues we address in the paper to be presented at the conference. Critical pathways are complex by nature and the need for IT infrastructure is crucial to their successful adoption and diffusion into the healthcare delivery system. Unfortunately, physicians have barriers which preclude adopting new technology which in turn may prevent them from adhering to new guidelines in standardized patient care. Through appropriate use of the research literature, the TAM Model, and the extended TAM model, the author will investigate the physician barriers and offer possible solutions for adoption and diffusion of technology which could bolster sentiment for an integrated approach to treatment of illness and disease.

Key Words: Critical pathways, IT-Stress, TAM, Africa, healthcare.

Introduction

The critical pathways algorithm has enjoyed a long history even prior to its appearance in modern medicine. The step-by-step approach to solving problems was the brainchild of Persian mathematician, Al-khaforizmi, who invented it in the 19th century. The original purpose of the algorithm was to solve arithmetic problems. With the advent of the computer in the mid-20th century, there ensued a rapid development of detailed and more complex step-by-step solutions. Experts used algorithms to develop logical methods of instruction to enable operators to direct a computer effectively (Mozena 1996).

For the last 25 years, the step-by-step of approach has been slowly making headway into the field of medicine and the health care industry. Medical authors began in the late 1960's to discuss the use of such a stepwise approach to solving the problems faced in the everyday clinical setting. This in as environment ideally suited to the use of algorithms, as clinicians must make a series of sequential decisions in caring for each patient to determine the appropriate treatment for the patient. A fully

developed algorithm can facilitate this decision-making process and help ensure that the patient receives optimum care (Mozena 1996).

As the algorithm became more accepted and medicine progressed to the current state of patient centered care, the clinical practice guideline emerged. It “is a systematically developed statement designed to assist practitioner and patient make decisions about appropriate health care for specific clinical circumstances.” (Shoenbaum 1995) Specifically, clinical practice guidelines function as follows:

- Clinical practice guidelines are collections of practical information for use by doctors and other medical professionals.
- Often, these are gleaned from systematic review of medical journals and other published material.
- They are a prime tool for evidence based medicine, and require frequent updating as new information becomes available.

History of the Clinical Practice Guideline

As far back as times described in the Old Testament, medical guidelines were common. The book of Leviticus, for example, contains a discussion of the symptoms and treatment of leprosy; it includes instructions that advised the priests of the day to look at the hair and the skin of those who may be afflicted with leprosy. Based on their findings, they were then instructed to treat the patient in a certain manner. Thus, the priests used a primitive form of an algorithm during the decision-making process regarding such a patient.

Moreover, it is the initial standardization of Medical Education that ultimately lead to the standardization of Medicine overall. The fact is that every clinician uses clinical algorithms to accomplish the daily work of caring for patients. Medical students and interns carry algorithms around in their pockets in the form of a *Washington Manual of Medical Therapeutics*. Every physician – every clinician – follows the same pattern when they care for patients.

Unfortunately, their internal protocols suffer from two grievous diseases of our own: They rely upon subjective judgment and achieve outcomes subjectively; and they exclude the patient care experiences of their colleagues. Formal clinical algorithms address both of these deficiencies by giving a framework within which to interpret clinical experience. A written clinical algorithm, backed

up by an objective tracking system and applied across a group of collaborating clinicians improves the quality and quantity of information physicians learn from clinical experience.

Additionally, the practice of medicine is governed by the Pareto (or 80/20) Rule which states that 80 percent of clinical outcomes are achieved by 20 percent of clinical activities. The algorithm makes it possible to analyze actions, eliminate inefficiencies, and optimize the resources of both the clinician and the patient. The ability to focus on a few vital steps in a clinical process enables clinicians to become more efficient, and therefore, they can decrease patient costs, increase revenue for the organization, and increase their satisfaction. Thus, by creating and using clinical algorithms, clinicians can ensure that they are providing their patients with the care accepted as best practice.

Individual Physician Practice

C.Z. Margolis, a major researcher and contributor on clinical practice guidelines, critiqued the 3 major objections of most critics on the use of clinical algorithms in medicine. In the JAMA article, *Uses of Clinical Algorithms*, he stated the most often given objection is that algorithms will turn physicians into robots who do not have to think. Every medical discipline has critics of the “cookbook” approach for treating patients. According to these critics, physicians who use algorithms will gather information from the patient and simply turn to the relevant box in the algorithm to determine the appropriate treatment. The critics contend that this approach will hold any thinking on the part of the physician to a minimum (Margolis 1983).

Margolis argued just the opposite, however. In his view, the use of a structured approach to clinical problem solving actually facilitates thinking about a clinical problem, because it enables the practitioner to think more clearly about the situation. Furthermore, an algorithm is especially useful for medical situations that the clinician does not regularly encounter. It provides a framework for the decision-making process since it assists the practitioner by providing a logical sequence of considerations used by other clinicians who are considered experts in this field (Margolis 1983).

Second, the critics commonly object to clinical algorithms on the ground that they are general and will not be applicable to a specific patient. Margolis agreed that every patient is unique. Only after a careful and thorough examination by the physician will a patient fit into an algorithm. At every decision-making point along the way, the clinician decides if this unique patient fits into the algorithm.

Finally, Margolis noted, some authorities believe that not all physicians are able to think “algorithmically”. However, experienced physicians acknowledge that they follow an algorithm in their head whenever examining patients (Margolis, 1983). Thus, although an algorithm written into an

official document may be somewhat intimidating, it represents a technique that experienced clinicians actually use on a daily basis.

The persuasive arguments of Margolis notwithstanding, many clinicians continue to express concern over the use of algorithms in medicine. They perceive algorithms as restrictive and fear that algorithms will limit the clinician in practicing the “art” of medicine. Because of these objections, the use of algorithms, in medicine has had a dismal record. It has been very difficult to get clinicians to accept algorithms. As a result, very few have been successfully implemented.

Physician Barriers to Adherence

Physicians find that they have less and less time to interact with patients that are treating today. While many believe that clinical practice guidelines will help physicians to cut down on redundancy, medical errors, and medication errors, physicians as a group still overwhelmingly reject the use of clinical practice guidelines. The areas they disagree with are as follows:

- Lack of Awareness
- Lack of Agreement
- Lack of Self-Efficacy
- Lack of Outcome Expectancy
- Lack of Cueing Mechanism

Michael Cabana has written extensively in the article, *Barriers to Adherence*, which illustrates the most common barriers physicians face. First, lack of awareness is when the physician states “I didn’t even know about the guideline” (Cabana, 1998). There are over 4000 medical journals in circulation and nearly 2500 clinical practice guidelines, and with an average of only 3 to 4 hours a week to read, the average physician faces a challenge in keeping abreast of current clinical practice guidelines. The readability of guidelines also affects awareness. Presentation and formatting of the guidelines are important considerations and guideline developers have to tread the fine line between being too cumbersome and complex and being too simplistic.

Next, in lack of agreement the physicians state “I heard about the guideline, but I don’t think it is correct” (Cabana, 1998). Even if a physician is aware of a guideline, disagreement arising from interpretation of the evidence, lack of credibility of the guideline developer, lack of physician involvement in guideline development, or incompatibility with local practice can lead to non-adherence (Cabana 1998). Guidelines developed through consensus, even of a panel of experts, may put together the biases, oversimplifications, and errors into one document.

Another barrier to adherence encountered is “I think it is important but I don’t have the time or skills needed to do it properly.” Lifestyle modification is often recommended under clinical practice guidelines. However, three major barriers prevent their optimal implementation – lack of reimbursement, lack of time, and lack of skills. Thus, physicians are not reimbursed by third party payers on time spent counseling patients on lifestyle modifications. An added disincentive is that even implementing a guideline could increase a practice’s administrative costs. The time constraints on a brief office visit preclude any detailed counseling on lifestyle modifications, which do not necessarily address the patient’s immediate complaint.

Lack of outcome expectancy is another barrier to adherence in that physicians feel “I’m sure it works in the ideal world, but in my practice it probably won’t make a difference” (Cabana, 1998). Factors beyond a physician control may influence the decision to adopt guidelines. Thus, certain medications may not be prescribed because of the financial situation of the patient. Lack of patient interest and belief that a patient will be noncompliant may be a deterrent to advocating lifestyle changes. Also physicians may be viewing guidelines narrowly, as to their impact on just their practices, and not seeing the overall effect of guideline adoption.

Finally, physicians suffer the lack of a cueing mechanism to alert them to use the clinical practice guideline. Physicians say “I know I’m supposed to do it; I just forgot” (Cabana, 1998). A physician has to attend to several competing issues during a patient encounter and may need a constant reminder such as a checklist, which may improve adherence to the guideline. In one randomized controlled trial, to test an intervention for changing physicians’ prescribing patterns, providing a one page guideline reminder along with a list of patients receiving calcium channel blockers led to a prescription change in 11% of patients (Cabana, 1998).

Evolution to the Critical Pathway

As the complexity of medicine has grown so has the move toward an integrated, multidisciplinary team approach. “Critical pathways are care plans that detail the essential steps in patient care with a view to describing the expected progress of the patient. The review of the literature by the author suggests the use of critical pathways reduces the cost of care and the length of patient stay in hospital. They also have a positive impact on outcomes, such as increased quality of care and patient satisfaction, improved continuity of information, and patient education.

Additionally Critical or Clinical Pathways include many different names that are synonymous with the team approach to care they provide such as, Integrated Care Pathways, Multidisciplinary Pathways of Care, Pathways of Care, Care Maps, and Collaborative Care Pathways. The four main

components of the critical pathway are a timeline, the categories of Care/Activities and their interventions, intermediate and long term outcome criteria, and the variance record.

The Critical Pathways have presented many opportunities to help transform the healthcare delivery system:

- Support the introduction of evidence-based medicine and use of clinical guidelines
- Support clinical effectiveness, risk management and clinical audit
- Improve multidisciplinary communication, teamwork and care planning

- Can support continuity and co-ordination of care across different clinical disciplines and sectors;
- Provide explicit and well-defined standards for care;
- Help reduce variations in patient care (by promoting standardization);
- Help improve clinical outcomes;
- Help improve and even reduce patient documentation
- Support training;
- Optimize the management of resources;
- Can help ensure quality of care and provide a means of continuous quality improvement;
- Support the implementation of continuous clinical audit in clinical practice
- Support the use of guidelines in clinical practice;
- Help empower patients;
- Help manage clinical risk;
- Help improve communications between different care sectors;
- Disseminate accepted standards of care;
- Provide a baseline for future initiatives;
- Not prescriptive: don't override clinical judgment;
- Expected to help reduce risk;
- Expected to help reduce costs by shortening hospital stays
(www.openclinical.org/clinicalpathways.html 2007)

CDC/JCAHO/National Patient Safety Foundation/IHI

Many national organizations have entered the fight to make critical pathways and clinical practice guidelines the standard for best practice of quality patient care. In 1981, the Centers for Disease Control and prevention (CDC) published a manual, *“Guidelines for the Prevention and Control of Nosocomial Infections,”* containing nine clinical guidelines for infection prevention and control hand washing. The publication and widespread dissemination of these guidelines revolutionized practice because it was the first time that a federal agency had gathered recommended,

evidence-based standards of practice to prevent infections into a single document. Although CDC has been consistently careful through the years to emphasize that these guidelines are not regulatory, they are taken very seriously by essentially all hospitals and serve as the basis for accreditation and standard setting. In fact, if a healthcare institution does not comply with the guidelines, they may be required to provide an acceptable rationale in order to become fully accredited (i.e., the guidelines are considered the “gold standard” for practice (Larson, 2003). The CDC is currently the largest archivist of practice guidelines and works in conjunction with the National Guideline Clearinghouse, AHRQ, and other entities worldwide to warehouse and promote utilization of the guidelines.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) evaluates and accredits nearly 17,000 health care organizations and programs in the United States. An independent, not-for-profit organization, JCAHO is the nation's predominant standards-setting and accrediting body in health care. Since 1951, JCAHO has developed state-of-the-art, professionally based standards and evaluated the compliance of health care organizations against these benchmarks. Its mission is to continuously improve the safety and quality of care provided to the public through the provision of health care accreditation and related services that support performance improvement in health care organizations. (www.jcaho.org, 2007)

In support of this mission, in 2002, JCAHO introduced Shared Visions-New Pathways, an initiative that focuses accreditation on operational systems that are critical to the safety and quality of patient care. Finally, the mission of the National Patient Safety Foundation (NPSF) is to improve measurably patient safety in the delivery of health care by its efforts to:

1. Identify and create a core body of knowledge;
2. Identify pathways to apply the knowledge;
3. Develop and enhance the culture of receptivity to patient safety;
4. Raise public awareness and foster communications about patient safety; and
5. Improve the status of the Foundation and its ability to meet its goals.

As a continuation of this list, other examples of movement to a standardized approach to medicine have come from the Institute for Health Improvement (IHI). They have enacted guidelines for the treatment of many diseases to include heart disease, diabetes, and hypertension. Following is an excerpt from their website which details guidelines for HIV/AIDS that they seek to have embedded in the health care delivery system as a standardized approach to improve patient treatment (www.ihl.org 2007).

6. Consider use of specialized software to "couple" guidelines with clinical care decisions.

8. Consider conducting a baseline chart audit to benchmark your current practice against agreed-upon guidelines.

9. Use flow sheets, pathways, or checklists to embed guidelines into daily practice and into the registry system. The guidelines include triggers for care. Print out flow sheets prior to each visit. During the visit, incorporate the plan for the next visit on the flow sheet.

These improvements are also being used in benchmark hospitals nationwide. "Clinical quality improvement efforts at the Medical Center Hospital of Vermont (MCHV) led to the development of critical pathways, which show the ideal plan of care, and algorithms, which help clinicians, make one of many complicated decisions within a plan of care. A synergy appears to develop when pathways and algorithms are used together" (Schriefer, 1994). Benchmarks being the capstone of quality, it is the endeavor of hospitals like these to incorporate quality and value into each patient encounter as they move to a patient-centered care approach.

Current Need for Information Technology

Critical pathways are complex by nature and the need for IT infrastructure is crucial to their successful adoption and diffusion into the healthcare delivery system. Unfortunately, physicians have barriers which preclude adopting new technology which in turn may prevent them from adhering to new guidelines in standardized patient care. "With development of managed care markets, health care delivery systems face increasing clinical and financial risk. For an integrated delivery system to survive, strategies for clinical integration and care management are essential. CareMap tools, collaborative practice groups, and case management serve as the foundation to accomplish care management over the health continuum. Coordination of care, within an institution and across traditional health settings, to achieve the best clinical and cost outcomes is the goal. The article discusses strategies for clinical integration, categories for measurement of performance, and the need to incorporate automated solutions into the strategic business plan (Hill, 1998). IT planning and infrastructure is necessary for the successful use of Critical Pathways.

Technology Acceptance Model (TAM)

Following an exhaustive search of the literature, an appropriate theoretical model to assist in understanding why physicians have barriers to adopting new technology. The Technology Acceptance Model which is an adaptation of Theory of Reasoned Action has both behavioral elements and the intention to act. Incumbent in the model are the component of perceived usefulness and perceived ease of use to determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. Previously researchers have simplified TAM by removing the attitude construct

found in TRA from the current. Attempts to extend TAM have generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of perceived usefulness and perceived ease of use (Venkatesh, 2003). The original TAM model is as given in Figure 1.

TRA and TAM, both of which have strong behavioral elements, which assume that when someone forms an intention to act, that they will be free to act without limitation. In practice constraints such as limited ability, time, environmental or organizational limits, and unconscious habits will limit the freedom to act.

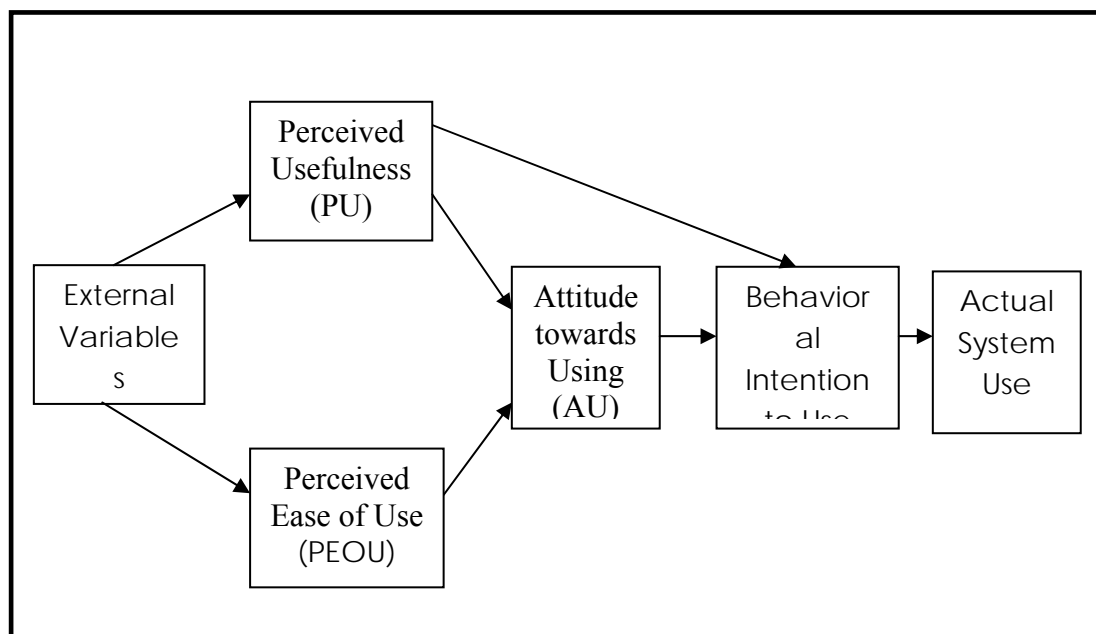


Figure 1: Technology Acceptance Model (TAM)

[Adapted from Davis, et al., 1989]

An additional phenomenon was added to the model to account for direct and indirect stress to include, computer anxiety, technophobia, technostress, consequences, work related stress and anxiety. This direct stress is caused directly from either using or only being somehow involved with information technology. Direct IT-stress can

occur from person's fear of breaking something, feeling of ignorance, fear of technology, fear about health, and fear about anything new and unfamiliar or sense of threat to intellectual self assessment (Raitoharju, 2005). The literature has also suggested that psychosomatic syndromes in the workplace will most likely increase in the future due to the rapid changes in work life.

Working with IT daily can also cause indirect stress. This can occur when a user feels comfortable using IT but the technology takes too much time and leaves not enough time to complete other work tasks properly. This pressure of unfinished work can result in stress that is indirect due to IT. Comfort in using the IT is a huge barrier for physicians but the loss of time spent treating patients or interacting with colleagues on difficult cases can lead to further indirect stress.

The application of the TAM Model in healthcare is not without its criticism. Some believe that certain systems are not suitable to healthcare. Although TAM model pays attention to users' acceptance it is done by assuming that more acceptable the system is among the users, the more they use the system. Since nowadays in health care the use of information technology is often mandatory, certain information must be. Also, the lack of focus on the stress factors is seen as significant barrier to adoption and diffusion of IT. Finally, some technology is not useful under certain circumstances and it also may not be easy to use. All these factors can directly affect the success of technology in the healthcare delivery system. The main idea is that IT-stress is a considerable factor in organizations and therefore also an important field of evaluation.

IT-Stress Based TAM Model

While the TAM-model has many useful points, it may not be ideal when evaluating the health care sector. The TAM model assumes that employees who do accept and use technology therefore, do not encounter stress. Computer anxiety was a negative predictor for perceived usefulness. Computer anxiety was also found to be negatively related to end-user acceptance. Users' attitude towards IT was found to play an important role in explaining IS use (Raitoharju 2005). In the combined IT-stress TAM-model, perceived ease of use and perceived usefulness are assumed to decrease the level of IT-stress. However it is a two-way direction; when employees suffer from IT-stress they do not see the technology to be useful or easy to use.

Moreover in the model the use is still with but not as a goal of the acceptance but rather an important factor among the others when studying IT-stress and success of information technology. The purpose of the new model (shown in Figure 2) is to take IT stress in to the discussion of IT evaluation especially in health care. The main idea is that IT-stress is a considerable factor in organizations and therefore also an important field of evaluation.

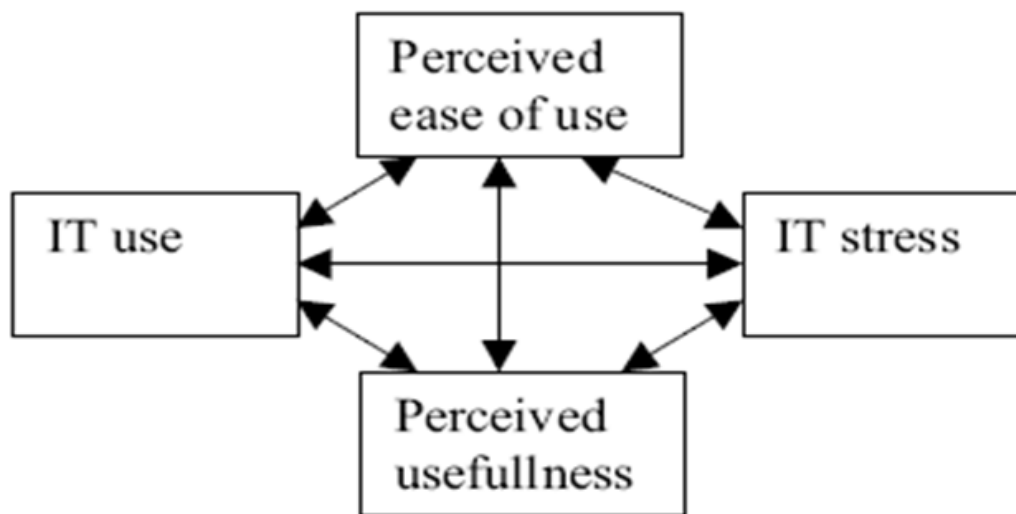


Figure 2: IT Stress-Based TAM Model (Extended)

Barriers to Physician Adoption of IT For Use With Critical Pathways

Some consistent themes which emerged from the literature suggest that physicians have barriers to IT adoption which is different from other health care professionals. Their unique problems must be addressed within the healthcare delivery system to help better integrate Critical Pathways for IT adoption and diffusion. The emergent themes are as follows:

- May appear to discourage personalized care
- Risk increasing litigation
- Don't respond well to unexpected changes in a patient's condition
- Suit standard conditions better than unusual or unpredictable ones
- Require commitment from staff and establishment of an adequate organizational structure
- Problems of introduction of new technology
- May take time to be accepted in the workplace
- Need to ensure variance and outcomes are properly recorded, audited and acted upon.

Future IT Presence in Evidence Based Medicine

The opportunities for clinicians to engage in best practice through evidence-based medicine are endless. For it to happen, there must be a concerted effort by physicians and IT personnel to find the best technology for their organization. In the future, clinical integration of clinical, financial, and organizational components of the IT system will be necessary to meet these goals. There will also be a

greater emphasis on the Clinical Decision Support Systems (CDSS) for use by executives to plot the best strategy for the health care organization.

Innovation in healthcare will push standardized medicine to web based delivery, PDAs, and hand-held tools for ease of use and convenience for physicians. Paper-based ICPs will become vestiges of the past and will be replaced by Electronic ICPs which will have intuitive systems that cue their use at all optimal points of patient treatment and care. Finally, measurable quality and performance will continue to grow and expand in the reimbursement mechanism of health care and the new continuum will be fully patient-centered.

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