



FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES
Department of Information Systems

A FRAMEWORK FOR DEVELOPING CITIZEN-CENTRIC E-GOVERNMENT APPLICATIONS IN DEVELOPING COUNTRIES: THE DESIGN-REALITY GAP IN UGANDA

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Abstract

Title: A framework for developing citizen-centric e-government applications in developing contexts: The design-reality gaps in developing contexts

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E-government should be at the heart of service delivery in developing countries if the life of citizens, especially the socially and economically marginalised, is to be improved. Often in developing contexts, citizens have been treated as recipients of such interventions, in a top-down approach from central governments, resulting in the non-use of such interventions. A situation of non-use of e-services results in wastage of the public fiscus. The extant literature points to a number of underlying causes of the problem. One such problem is the “Design-Reality Gap.”

This study sought to identify and address such gaps with specific reference to Uganda. The aim of this study was to investigate and develop a feasible and realistic approach for undertaking participatory design of usable e-government applications while maintaining an awareness of the marginalized citizens’ several pressing needs. To understand such lived realities within a complex open environment, the study employed a multi-methodological participatory action research design while harnessing participatory design methods. Data in relation to design artefacts was collected through multi-dimensional case studies which served as units of analysis while working collaboratively with a team of 28 co-designers. The multi-dimensional case studies drew data from 40 citizens in a health setting and 20 e-government officials at a preliminary phase, and thereafter 425 citizens who operate small and medium enterprises for initial problem discovery and status quo establishment. The multi-dimensionality of user representation resulted in diversified contributions to the understanding of the complex participatory design reality.

The participatory design science research process adopted a preliminary co-design model, called 4Co-Ds as was derived from literature, and comprised a four-pronged iterative model that incorporated Design Science Research 1 (DSR1) **Co- Discovery**, Design Science Research 2

(DSR2) **Co-Definition** of Problems; Design Science Research 3 (DRS3) **Co-Development** and Design Science Research 4 (DSR4) **Co-Delivery** of Solutions within the entire participatory design framework. This framework served as a basis for testing a participatory design process within a critical realist world view. Under a critical realist's viewpoint, the multi-methodological approach that was adopted provided a robust understanding of the complex realities under investigation.

Results based on the aforementioned methodology reveal that among the several methods of designing for the marginalised communities, designers should put aside their own design intuition and design ambitions and incorporate empathetic participatory design. Whereas the study envisioned existence of a design-reality gap, findings revealed several gaps that include: policy gaps, national e-government strategic gaps, global to national commitment gaps and most importantly, designer-citizen user gaps. From a user perspective, during usability experiencing, designers should corroborate empathetic participatory design with several iterations of user involvement to refine the design process and resultant artefact. The study also determined that user representation involvement narrows the design-reality gaps, thereby achieving the alignment of user mental models with the designer conceptual models. Lastly the study demonstrates that co-design and participatory design incorporate implicit and explicit knowledge into the design space thereby enriching the information systems design body of knowledge.

The study therefore informs e-government policy and contributes to practice and the multi-disciplinary information systems' body of knowledge through its outcomes and outputs. These comprise the assembled methods, artefact, design science research theory, design methods, interface evaluation criteria and evaluation tools. Over and above, the notion of empathetic participatory design when developing solutions for marginalized setting communities is emphasized.

Key words: *participatory design, empathetic participatory design, co-design, marginalised citizens, e-government, design science research, design theory, participatory action research*

Declaration and approval

I declare that this thesis entitled ‘*A framework for Developing Citizen-Centric e-government Applications in Developing Countries: The Design-Reality Gap in Uganda*’ is my own work. It has never been submitted before for the award of any degree or examination whatsoever in any other university, and that all sources I have used or quoted have been indicated and acknowledged as complete references.

This final thesis has been submitted for publication after addressing all examiners’ corections and after approval by my academic supervisors.

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List of acronyms

AC	:	Authority Centred
C2G	:	Citizens to Government
Co-Ds	:	Co-Discover, Co-Define, Co-Develop, Co-Deliver
CoP	:	Community of Practice
DRM	:	Design Research Methodology
DSR	:	Design Science Research
DSRP	:	Design Science Research Processes
ECSF	:	e-Government User Centric Satisfaction Framework
e-GOVERNMENT	:	Electronic Government
FGD	:	Focus Group Discussion
G2C	:	Government to Citizens
HCI	:	Human Computer Interface
ICT	:	Information and Communications Technology
ICT4D	:	Information Communications Technology for Development
ICT-SIP	:	ICT Sector Strategy and Investment Plan
IS	:	Information Systems
ITPOSMO	:	Information, Technology, Process, Objectives and Values, Staffing and Skills, Management Systems and Structures, Other Resources
ITU	:	International Telecommunications Union
MFPED	:	Ministry of Finance, Planning and Economic Development
MoICT	:	Ministry of Information and Communications Technology
NDP	:	National Development Plan
NISS	:	National Information Security Strategy
NITA-U	:	National Information Technology Authority, Uganda
NPM	:	New Public Management

OECD	:	Organization for Economic Co-operation and Development
PC	:	People Centred
RCDF	:	Rural Communications Development Fund
RCIP	:	Regional Communication Infrastructure Program
SDLC	:	Software Development Life Cycle model
ToC	:	Theory of Change
UMCS	:	Unified Messaging and Communication System
VMGF	:	Vulnerable and Marginalised Groups Framework
WSIS	:	World Summit on the Information Society
XML	:	Extensible Markup Language



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Glossary/operational definition of concepts

This glossary seeks to define and explain some of the main concepts underpinning evidence based design science research. It draws on the published literature, experience gained over several years analysis of the topic, and discussions with information systems and e-government colleagues, including researchers, practitioners, policy makers, and students. Whereas there are different ways of knowing the same named concept, critical realist ontology allows for re-interpretation of the activities of science as implicitly predicated upon natural and social realism as well as the concepts of structures and generative mechanisms. Such interpretation and re-interpretation provides greater explanatory power vis-a`-vis current research practices and resolves the theory-practice contradictions (Smith, 2006).

- Artifact/artefact US/UK spellings respectively to mean an object produced or shaped by human craft or effect observed in a system, especially one introduced by the technology used in scientific investigation. This study adopted use of ‘artefact.’
- Co-design: From prefix ‘co’ meaning subordinate and ‘design.’ Is when the study conducted among the design team members as subordinates to the principle investigator, taking and switching roles of designers and users, not necessarily with participatory activities. Or a process of running an innovation project in which a variety of actors are used to work on a shared solution. Co-design leans more on teaching the skills to the recipients of the process.
- Co-problem discovery: Design team deliberates through a number of research and design activities to understand the actual designable problem from a number of ideas generated from users or citizens. i.e users/citizens generate ideas which to them are problems while design team in-house draws insights from these ideas into real designable problems.
- Design: A verb to imply a decision upon the look and functioning of a system by making a detailed drawing of it; and a noun to imply a plan or drawing produced to show the look and function or workings of a system before it is developed.
- Design-reality gap(s): The difference between the current reality of citizens and the design proposal or actual implementation for the new e-government project
- Design research the study of design itself, its purpose, processes and outcomes.

Design science	studies the creation of artefacts and their embedding in our physical, psychological, economic, social and virtual environments.
Design science research:	systematic inquiry which goal is knowledge of, configuration embodiment, structure, composition, purpose, value, and meaning in man-made things and systems.
Design thinking:	Involves a process that foresees steps to allow participants (design team and citizens) to analyze, synthesize, diverge and generate insights from different domains through drawing, prototyping, role plays and storytelling. Design Thinking is about the creation of, as well as adaptive use of a body-of- behaviors and values.
Digital divide	the gulf between those who have ready access to computers and the Internet, and those who do not.
Empathetic design:	Is a user-centered design approach that pays attention to user's feelings towards the product.
Empathetic participatory design:	sharing methods and reflections of designing 'with' and 'for' empathy through practice design activities and switching roles as users and designers.
Ideation:	Is a Design Thinking task aimed at generating a large quantity of ideas that the design team can then filter and cut down into the best, most practical or most innovative ones in order to inspire new and better design solutions and products.
Marginality:	Is an involuntary position and condition of an individual or group at the margins of social, political, economic, ecological and biophysical systems, preventing them from access to resources, assets, services, restraining freedom of choice, preventing the development of capabilities.
Marginalization:	An exclusion at individual or community level from meaningful participation in society.
Marginalized:	A description of a person, group, or concept treated as insignificant or peripheral.
Paradigm:	Is a way of thinking or a way of looking at something or a world view one holds.

Participatory Action Research: Is a research design, paradigm and approach to research in communities that emphasizes participation and action. It seeks to understand the world by trying to change it, collaboratively and following reflection

Participatory design: Is a design methodology when end users are integrated into application development (prototyping and artefact design). Or a high participative mobilization of a variety of individuals, especially the public and developers work iteratively together for breakthrough innovations that meet their needs. Participatory Design stresses more the involvement factor.

User experience design: Is to design users' experiences of things, events and places through working with them as partners.



THESIS OVERVIEW

SUMMARY FRAMEWORK

“In brief and outline narrative form, the thesis should have a unified structure as a high level guiding framework,” (Easterby-Smith et al., 1991).

Introduction

Whereas this is not a chapter on its own, it describes the main structure and elements of this thesis. It serves to provide the reader with a high level overview of the thesis, as illustrated in Figure 1:

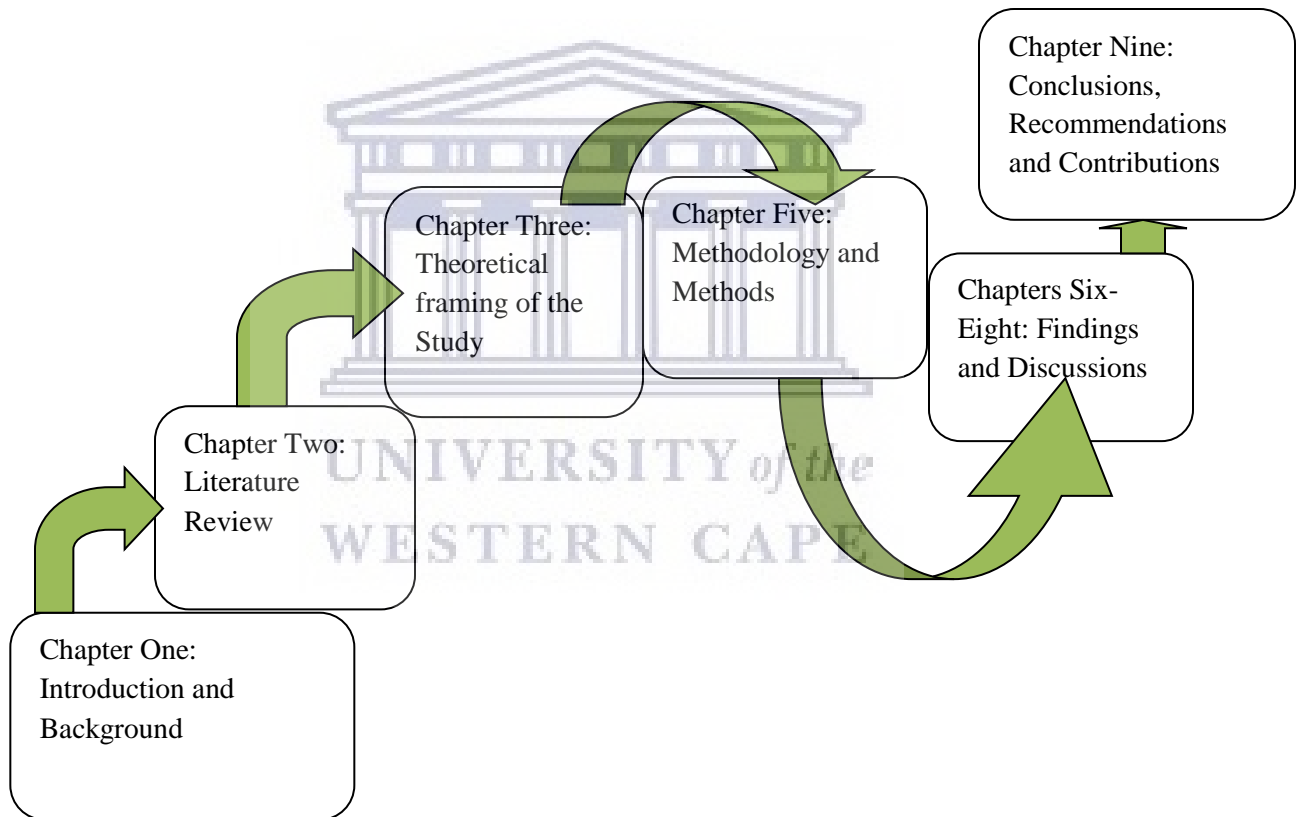


Figure 1: Thesis Framework Structure

Thesis framework structure narrative

In brief and outline narrative form, the thesis should have a unified structure as a high level guiding framework, (Easterby-Smith et al., 1991). Following are section narratives of the sections of the thesis.

Chapter One: Introduction and Background to the Research Problem

The chapter offers a conceptual and contextual understanding of key items of the study while highlighting some of the pointers to the design-reality gaps. Such a conceptual and contextual understanding results in a refinement of the research problem rooted in available evidence-based information.

This chapter also presents a background to the research problem by drawing on literature in relation to e-government in general and C2G/G2C in particular. It explores the rationale for the need for citizen-centric designs and how a lack of the same results in design-reality gaps as a root cause of this thesis investigation. The chapter then presents a statement of the problem, research objectives and questions, as well as design activities as data sources for each of the research objectives. Finally, it offers an alignment of the primary research question to the research sub-questions, methods and research objectives based on four design science research iterations abbreviated as Design Science Research (DSR) phases (DSR1, DSR2, DSR3 and DSR4).

Chapter Two: Literature Review

This chapter offers conceptual and contextual understanding of key items of the study while it highlights pointers to the design-reality gaps in a much more depth. The methodology for undertaking literature review is provided and literature related to the study objectives undertaken. The review is high-level in the sense that it leaves room for flexibility to be updated during fieldwork, a widely recommended technique in design science research. The chapter documents the available body of knowledge, highlighting the gaps in literature this work attempts to fill.

Chapter Three: Theoretical Framing of the Study

In order to ensure the study's theoretical validity, meta-scientific theoretical review is undertaken to establish contemporary issues of e-government for citizen designs within philosophical overarching theory. The logic of an enquiry flows from broad philosophical assumptions to specific questions and then to methods used to answer said questions. Philosophical assumptions (worldviews) guide the enquirer's perspective of the world into which the research is conducted (ontology), the knowledge pursued (epistemology), the values brought to enquiry (axiology) and

the language used (rhetorical approach). Specifically, the rationale for the choice of Critical Realism as a guiding world view to guide designerly research is offered. Within the meta-theoretical lens, the study situates the design theory and associated contemporary debates. The rationale for positioning design theory as a second layer of theoretical abstraction within Critical Realism is also provided. Moreover, e-government branch of information systems is both interdisciplinary and multidisciplinary. This study therefore draws from multidisciplinary theories within disciplines such as computer science, psychology, governance/public administration, ICT4D and software engineering among others to establish theoretical naming during development of a *priori* theoretical framework that guided the study.

Chapter Four: Methodology and Methods

The chapter presents the process of investigation (methodology) and the strategies for collating evidence (methods). It is aligned to the theoretical framing of the study since without a focused worldview, research work cannot progress smoothly. The assumptions made during the research process offer a scientific investigation of what I term a '*Golden Thread*'. The research design is presented, sampling and sampling methods and data collection methods. As observed, this is research through design where the artefact is used as a strategy to collate the data. In terms of quality of the results, validity and reliability of multi-methods methods and tools is presented. The chapter concludes with a discussion on data management and triangulation since design research work generated both statistical and non-statistical data.

Chapter Five: Results of the Pilot Phase

This study has a number of outcomes. A number of scholars from various design science schools of thought have identified results section of design science research as inconsistent. When some studies report the design research process, they do not report the outcomes. When others report both design and research process, they leave out the artefact evaluation component and designate it as ex-post evaluation. Among the three other results, chapter seven (7) reports the results of the pilot design science research study for tool testing and early problem discovery from citizens working in the health sector.

Chapter Six: Results of the citizens' status quo regarding e-government

This chapter reports the structured survey results among the 425 citizens to establish their pre-usage beliefs and attitudes regarding use of e-government. The aim is to establish their status quo regarding e-government adoption. Within the same chapter, unstructured field results from interviews report the problems revealed for detailed e-government prototype and artefact development by the co-design process during an empathetic participatory design process.

Chapter Seven: Results of the Empathetic Participatory Design Phase

Prior to embarking on community participatory design processes, design teams need to engage in a detailed preparatory exercise by examining the potential user demographics, context and user situation through a process of empathetic participatory design (*In* Kyakulumbye, Pather and Jantjies, 2018; 2019). This chapter presents the empirical results of the empathetic participatory design where the design team endeavours to better understand a prospective user audience by living through common experiences or facing the same challenges related to usability as users may face.

Chapter Eight: Results of the Citizen Usability Experiencing Phase

This phase involves simulating the artefact among the citizen users to generate their evaluation criteria and align with the standing criteria generated during the empathetic participatory design phase. Detailed context-based issues are generated to enrich the design outcome and to validate the results in chapter six and seven.

Chapter Nine: Conclusions, Contributions and Recommendations

This thesis is premised on the principle that design science research should devise a course of action aimed at changing existing situations into preferred ones. This chapter presents the key lessons from the design research and highlights the contribution to the body of knowledge (information systems, design science research and e-government design), makes theoretical and practical contributions. It highlights areas for further research and provides limitations of the study since no study can be free from such limitations due to fallibility of human knowledge. The next chapters offer the gist of the entire thesis while unpacking a chapter by chapter.

CHAPTER ONE

INTRODUCTION

“Today, all countries are struggling to better meet citizens’ expectations through e-government, but few have the necessary and sufficient knowledge of these expectations,”

(OECD Delegates at 2008 and 2014 Hague Conference in the Netherlands).

1.1 Introduction and Background to the Research Problem

The above statement was made at the Organization for Economic Co-operation and Development (OECD) Leaders’ Delegates Conference for Agenda 2020 as they met to devise strategies for serving their citizens more effectively and efficiently using information systems in general and e-government in particular. It is espoused that e-government should be at the heart of service delivery in developing countries if the lives of citizens, especially the economically marginalised, are to be improved (Margetts & Dunleavy, 2002; Gurstein, 2011; Mutula, 2013). The penetration of the internet has greatly improved the ability to offer citizens access to government information and services (West, 2004; Bonsón *et al.*, 2012). At a minimum, this brings government into reach of citizens who endure costly travel to access government services (Chang & Kannan, 2008; Corbett & Le Dantec, 2018). In addition, e-government allows citizens to engage in collaborative discussions on issues that affect their lives and well-being (Macintosh, 2004; Amichai-Hamburger, McKenna & Tal, 2008; Linders, 2012). E-government can also offer accountability and transparency to citizens in regards to services from the higher levels of government especially where physical access may be problematic (Bertot *et al.*, 2010; Kadamudimatha, 2016; Ismagilova *et al.*, 2017; Ismagilova *et al.*, 2019).

Whereas such e-government benefits need to be inclusive in nature, it often excludes certain classes of people, termed *marginalised people* in this study (Beck *et al.*, 2004; Gigler, 2004; Dugdale *et al.*, 2005; Moresby & Guinea, 2018; Ismagilova *et al.*, 2019). Several authors have alluded to the marginalised being a person, group or concept treated as insignificant or at the periphery of services (Kagan *et al.*, 2002; Hussain *et al.*, 2012). Often in developing contexts, such groups have been treated as recipients of interventions, in a top-down approach from central governments (Mohan, 2002; Yeager *et al.*, 2013). This frequently results in the non-use or low adoption of such interventions (Kleine, 2010). A consequence of non-use of e-services is a

wastage of the public fiscus. It has therefore become imperative to investigate alternative ways to incept, design and deploy e-government (Welch *et al.*, 2004; De', 2005; Bannister and Connolly, 2014).

Heeks (2001, 2002, 2003) and Misuraca (2013) reveal that behind seemingly wonderful information systems projects in developing nations lies a reality that the majority of those projects are total or partial failures. Extant literature has referred to such failures as a design-reality gaps. Heeks and Bailur (2007) note that central to e-government success and failure is the level of change between “where we are now” and “where the government project wants to take the citizens.” This is referred to as a Theory of Change, pinning propositions to knowledge, assumptions, beliefs and hunches about how and why particular actions are expected to trigger particular change (Kail & Lumley, 2012). This nature of the design-reality gaps is what Heeks (2003) termed a *hard-soft-gap* – a failure to incorporate soft, human issues into design, resulting in undesirable effects after implementation (Dada, 2006).

Considering such design related challenges, the rationale of this study to develop a model to improve the design of e-government services is clear. Citizen-centric e-government has the ability to reduce operational costs and improve efficiency in service delivery through effective and efficient usability of such services (Ndou, 2004; Evans & Yen, 2006). For instance, Sigwejo, Bytheway and Pather (2013) note that the 24/7 services embedded in e-government reduce time and cost to the government. Several other benefits are presumed to be associated with e-government services, translating into direct service to users rather than the traditionally slow flow of paperwork between the government and its citizens.

This therefore underlies the need for development of citizen-centric models to design e-government applications. To ensure uptake, adoption and usability, it becomes important to investigate how to involve the e-government customer throughout the design lifecycle. Because governments in developing contexts are focused on bridging the digital divide by addressing the infrastructure access, they have left design in the hands of ICT technical experts (Schwester, 2009). This is further emphasized by Sigwejo and Pather (2016) who point out that most e-government services are implemented as technical projects and with implicit assumptions that citizens will use them, an assumption that has not eventuated. Such a techno-centric view of design is coupled with the concentration of e-government studies at national and not local levels,

making citizens lack the benefits that come with citizen-centric e-government services. Yet, the call to address citizen service provision through e-government initiatives have been conceptualized in varied beneficial perspectives (Lofstedt, 2012) as presented in Figure 2.

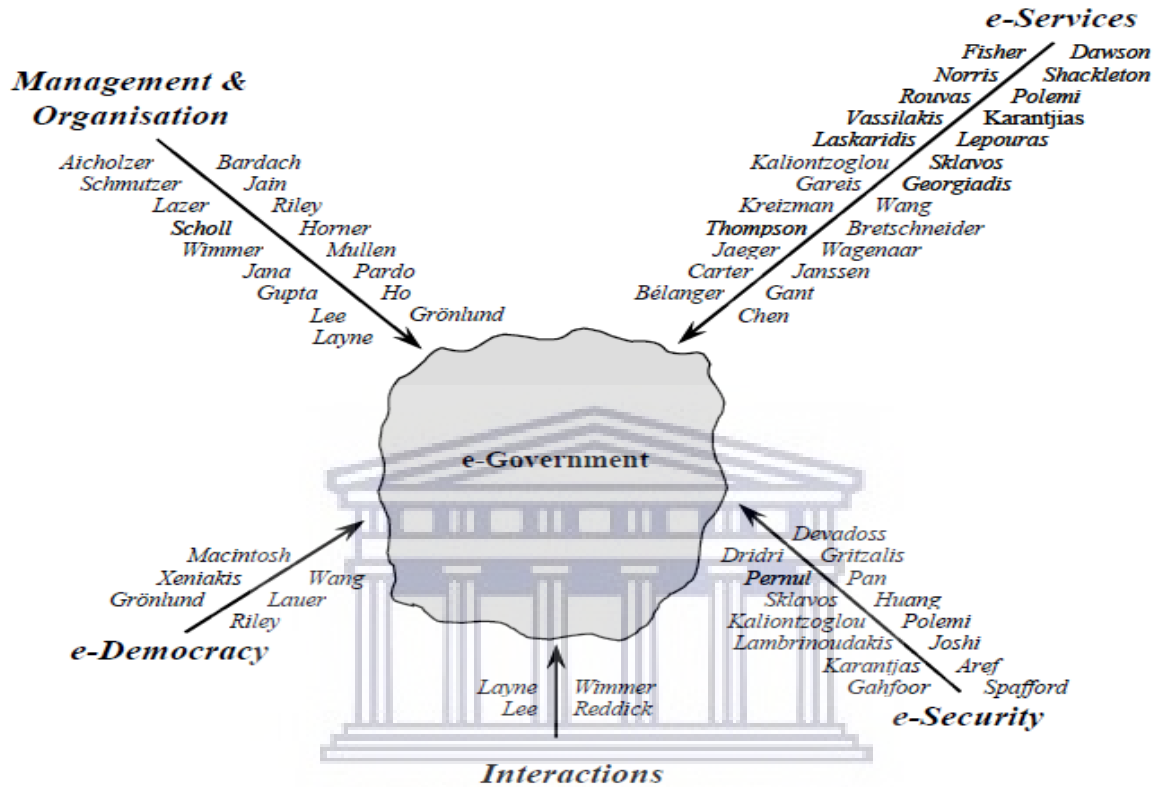


Figure 2: Citizen e-Government Services

(Source: Lofstedt, 2012)

In Figure 2, e-government is conceptualized as e-democracy, interactions, e-security, management and organization (Lofstedt, 2012), but my proposed study posits that citizen e-government services are essential for governments and their marginalised citizens. By experience, these services are, in fact, prerequisites for citizen appreciation of the other dimensions of service delivery. Such an assertion is in support of Helbig *et al.* (2009) who reveal that current interest is increasingly focused on the demand-side of the individual citizen than being dominated by the supply size of government. Such demand focused design of e-government could be a promise to meeting citizens' requirements. Research concerning user-related issues is thus becoming more frequent (Layne & Lee, 2001; Lofstedt, 2012). Interest in

the field of e-government is shifting focus from government at the national level to more citizen-related issues such as usability and user willingness (Pina *et al.*, 2010; Lambright, 2011).

The shifting of e-government research focus from national to citizen level has been guided by fiscal decentralization programs implemented in many developing countries that argue governments to address pressing issues at lower local governments parish and village levels (Baltaci & Yilmaz, 2006; Lambright, 2011). However, Grönlund (2004) and Shan *et al.* (2011) note that research at the local level with typical citizens is in short supply and suggest that the lack of e-government achievements at that level is a result of conflicting goals or other priorities of government agencies. Such varying priorities results in further conflicting realities between the citizens' needs and their respective governments' application designs (Choi *et al.*, 2016).

There is need therefore for a user-centric perspective in developing electronic government that have the capacity to meet these emerging service needs and demands of citizens and other clients (especially the marginalised citizens). This study therefore posits that while researches in relation to e-government have been undertaken, the challenges of usability unwillingness still prevail. As such, an approach to the problem from a co-design approach of e-government applications may offer a solution (Lind *et al.*, 2007; Bradwell & Marr, 2008; Saad-Sulonen & Horelli, 2010; Cleland, Wallace & Black, 2018; Moon, 2018). Whereas this study seeks to embark on problem solution through design science landscape, the next section offers a review of the context of e-government local landscape from global levels, cascading down to Uganda.

1.2 Contextual Background

This section articulates an understanding of e-government for citizens from a global, regional and Ugandan context. Situating a country's e-government readiness into a global perspective has been underscored throughout literature (Alghamdi, Goodwin & Rampersad, 2011). Globally, the use of ICT to revitalize and modernize government is recognized as a central theme, not only for management models, but also for developments that incorporate broader issues, such as the networked co-production of public services, accountability and social control (Anthopoulos, Siozos & Tsoukalas, 2007; Barbosa, Pozzebon & Diniz, 2013). Moreover, it has been observed that even at a global level, national e-governments have been driven by a top-down agenda

where such commitments are framed within global contexts (Anthopoulos *et al.*, 2007). These situations work poorly because such directives have inhibited the acceptance of e-government by citizens and public administration (Anthopoulos *et al.*, 2007; John, 2013).

Such top-down e-government implementations at a global level are premised in globalization that advocates for modernization across borders in spite of economic, political, social and cultural differences (Schuppan, 2009). This section reviews the global e-government commitments, contextualising Uganda's e-government. It analyses the global perspective and identifies possible design-reality gaps in e-government international policy implementation. It has been argued that while most studies analyse national e-governments as separate entities, it is better practice to analyse from a global perspective. This could help nations assess their service delivery competitiveness (Srivastava & Teo, 2006; Zhao, 2011).

1.2.1 Global e-Government Context and its Influence on National e-Government Services

Firstly, the World Summit on Information Society (WSIS+10, 2014) observe that e-government is an international agenda. Many countries view it as a platform for public administration reformation, an avenue to realize citizen needs, and as an effective way to solve many challenges ranging from reducing corruption to ensuring favourable conditions for further civic engagement (Kassen, 2014).

Through various Global Summits, e-government has been evolving from a technology-driven concept to one that centres on citizens (*idem*, p.52). Such an assertion implies that e-government is not only a technology-driven process in transformation of the public sector but also a social phenomenon that requires collaborative efforts from people at local, national and even international levels. The first collaborative global efforts in the promotion of e-government agenda can be traced to the results of the G7 Conference on the Information Society convened in Brussels in 1995 (Reidenberg, 1996). The forum's goal was to consolidate efforts in the formation of the Global Information Society. As countries making up about half of the world's global domestic product, the standards the G7 leaders set, as well as the commitments they make and the steps they take to solve global issues, fire up economies and drive prosperity all over the world (Horgan, 2012). Since the convention in Brussels, global pronouncements geared towards

advancing e-government across nations have been institutionalised. The likes of the World Summit on Information Society (WSIS+10, 2014) and the International Telecommunications Union (ITU, 2014) bring together government policymakers and players the world over, all of whom have influence national-level e-government initiatives.

At the World Summit on the Information Society (WSIS), the representatives of the peoples of the world adopted a common vision, identifying its main principles and challenges towards a people-centred and development-oriented information society (WSIS+10, 2014). The set fundamental aim of the WSIS process was to foster the use of technology to improve peoples' lives and to bridge the digital divide. The global society, too acknowledged there were gaps that required bridging. The report notes that most countries still have imbalances in universal access to information and knowledge. From such a submission, the most affected are developing countries that require specific context interventions. The union observes that international law, and in particular, the Charter of UN is applicable and essential to maintaining peace and stability and promoting an open, secure, peaceful and accessible ICT environment (ITU, 2014). Hence national e-governments employing mechanisms that are in operation and influence design outcomes, are invisible to citizens. It is important to ask, then, exactly who such global interventions are targeting.

In a nutshell, the global commitments reaffirmed the importance of ICTs in the development of information society, stimulating innovations, empowering those in developed and developing countries, providing access to information and fostering economic and social growth (ITU, 2014). Key conclusions relate to using ICT to bridge the service access and service utilization gaps among the marginalised through undertaking collaborative application designs with specific groups of citizens.

The WSIS+10 (2014) pronouncements are a clear pro-poor people commitment that, if well synthesized at national level into local contexts, could result in usable citizen e-government interventions especially for marginalised groups. Specifically, global pronouncements of e-government influence the country level e-government roadmaps and imperatives.

1.2.2 Uganda's Road Map towards e-Government

According to the National Information Technology Authority (NITA) Report, the government of Uganda has a strong belief that ICT has the potential not only to revolutionize the way government operates, but to enhance the relationship between government and citizens, government and businesses and with government-to-government departments (NITA, 2017/18). Uganda's road map to e-government began with the ICT Policy of 2003 that emphasized the need to build ICT infrastructure countrywide. Following the ICT policy, a national e-readiness survey was conducted in 2004. In 2005, an e-readiness survey was undertaken specifically for government (ITU, 2014).

The Government of Uganda recognizes the central role that the ICT sector plays in enabling national economic and social transformation. Accordingly, the government has put various policies and strategies in place to establish a conducive environment through which government and citizens can reap the social and economic benefits enabled by ICT (NITA, 2017/18).

Uganda's *Vision 2040*, currently in the second *National Development Plan (NDP II)*, consolidates previous national development strategies and future prospects and acknowledges the role ICT plays in national development. However, NDP II reveals a number of challenges that hinder further growth of the sector (NITA, 2017/18). It is noted in NDP II that in order to improve access to ICT infrastructure and its usage, as well as skills development in the sector, the following challenges need to be addressed: the limited ICT infrastructure network and an investment in research, innovation and human capital development. It also recommends policy reform to ensure increased local participation, including ownership of ICT infrastructure and businesses, in order to reduce the externalization of sector gains (NITA, 2017/18).

The National ICT Policy 2014 seeks to address some of these gaps through deepening utilisation of ICT services by government, private sector, not-for-profit ICT organizations and the wider citizenry (NITA, 2017/18). Other policies aimed at deepening ICT and e-government use in a way of improving citizen participation into service planning include: National Broadband Strategy 2016-2020, The Rural Communications Development Fund (RCDF), Digital Vision Uganda Campaign, National Information Security Strategy among others. Such e-government

readiness initiatives undertaken by the Uganda National Government are a precursor for e-government readiness. This has also been emphasized by scholars who reveal that ICT institutionalization by nations set a pace for e-government within a broader national reform agenda (Heeks, 2002; Heeks, 2010; Schlichter & Danylchenko, 2014; Choi *et al.*, 2016).

With all such initiatives and policies, e-government uptake has been reported to be extremely low in Uganda and recommendations made are that citizen users need to be involved to become active creators of online content, as well as conversationalists and critics (Van der Linden & Hengeveld, 2009; Lacity, Carmel & Rottman, 2011; Wakabi & Grönlund, 2015; McKenney & Reeves, 2018; Karubanga & Agea, 2019). In summary, the foregoing findings and recommendations re-achoe the need to devise strategies that boost citizen participation, especially at the lower local governments, in design of e-government applications if uptake is to be achieved.

1.3 Statement of the Research Problem

From the foregoing context and policy based analysis, the low uptake of citizen e-government applications have resulted into eminent characteristics of failure (Heeks, 2003; Heeks & Bailur, 2007; Bhuiyan, 2011; Adiyarta *et al.*, 2018). A consequence of under-utilised or unutilised applications is sunk costs of public funds (Saxena, 2005; Hong *et al.*, 2017; Mashaka *et al.*, 2019). E-government failures are categorized in several ways: correspondence failure, when system specification are not met; process failure, when systems despite correspondence to design are not developed into practice; interaction failure, when systems are successfully developed and completed, but are not utilized by intended users (Masiero, 2016).

Moreover at a more operational level, the CHAOS Report (2018), which measures projects against the CHAOS database using six metrics of being on time, on budget, on target, on goal, valuable, and satisfactory for the customer reveal that 50% of projects are partial failres and challenged, 15% are successful, and that 35% are total failures. User involvement features is in the top 20% of the metrics for projects that are successful. The CHAOS research among other studies show that projects that lack user involvement perform poorly (Bwalya & Mutula, 2016; CHAOS Report, 2018; Karubanga & Agea, 2019). Whereas CHAOS reports are based on US IT projects, in developing contexts, recent studies using Heeks' design-reality gap model, show that

significant progress has been made, but that important gaps between design and reality exist, hence, challenges persist (Dasuki, Ogedebe, Kanya, Ndume & Makinde, 2015).

It has further been observed that e-government implementation in developing countries is always less successful and objectively hard to achieve and the reason behind is a less citizen-centric approach (Asmi, Zhou & Lu, 2017). Alzahrani, Al-Karaghoul and Weerakkody (2017) reveal that citizen's aspects of trust (such as personality, culture, gender, experience, education level, beliefs and value systems) call for government agencies to consider some strategies to empower their citizens and increase their participation during e-government services design. To clearly understand such subjective factors like trust, several authors have argued for co-design framework within participatory design methodologies and design thinking principles (Bell & Nusir, 2017; Simonofski, Snoeck, Vanderose, Crompvoets & Habra, 2017). Paracha, Hall, Clawson, Mitsche and Jamil (2019) observe that for effective user engagement and involvement for trust building in citizen e-government applications, co-design, design thinking and participatory design, especially for marginalized users are commendable techniques (Simonofski, et al, 2017; Harden & Moore, 2019).

Despite candid recommendations provided to involve citizens and change the design midset to citizen-centric one, a lack of participatory e-government design has also been earmarked by the OECD delegates in The Hague Conference, who agreed that of recent, all countries are struggling to better meet user expectations, but few have the necessary and sufficient knowledge of these expectations (OECD, 2008; 2014; Wakabi & Grönlund, 2015; McKenney & Reeves, 2018). Moreover, there have been many e-government systems developed in the developing worlds. However, many fail to fit the purpose because of the lack of holistic involvement of the citizens in the design process (Karubanga & Agea, 2019).

This study envisioned that the foundation to bridging such gaps of challenged projects comprises the adoption of a citizen-centric approach during the life cycle (inception, detailed design, evaluation and deployment) of e-government service application development for citizens. This is because citizens, especially the marginalised, have competing priorities within their contexts, which can be revealed and addressed in a participatory design manner. Several other authors have rendered support to undertaking context-based designs that are user-centric through

participatory design practices, principles and theoretical frameworks (Sein *et al.*, 2011; Choi *et al.*, 2016; Hong *et al.*, 2017; Mashaka *et al.*, 2019).

1.4 Primary Research Question

The primary research question that this study sought to address was this: *“What are the elements that comprise a citizen-centric design approach to address the design-reality gaps during e-government services application development in developing countries?”*

1.5 Research Objectives

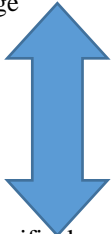
In pursuance of the primary research question, this study:

- a) established the pressing citizens’ ideas that can be refined into problems for e-government service design purposes and examined citizen status quo in regard to e-government (ICT) use and adoption in Mukono District, Uganda;
- b) examined how problem discovery and scoping takes place during a participatory design process among varied design team members;
- c) investigated how, in the design process, the profile of the citizen user and co-designers influence the design outcome in Mukono District, Uganda;
- d) examined how empathetic design of the co-design process influences the shaping of the evolving artefact designed with a citizen-centric mind-set;
- e) assessed the influence of end user participation (citizens) and artefact simulation on shaping and informing the evolving design outcomes; and
- f) synthesized the latter research and design processes into a participatory design science research framework for reducing the design-reality gaps identified during the process for improving e-government services among marginalized communities.

1.6 Design outcomes

Simon, one of the earliest originators of artificial intelligence observes that design outcomes are from design science and design research. Whereas design science is a body of intellectually tough, analytic, partially formalizable, partially empirical and testable discipline, design research moves from constructed technology (artefact) to design itself (design science) (Simon, 1996). From Simon's design science foundation base, a number of similar perspectives have been advanced in a bid to offer more clear understanding of the outcomes of design. Walls et al (1992) holds similar position that design science research outcome is a process and artefact. Gregor and Hevner (2013) guide that any Design Science Research project can produce artefacts on one or more of these levels ranging from specific instantiations at Level 1 in the form of products and processes, to more general (i.e., abstract) contributions at Level 2 in the form of nascent design theory (e.g., constructs, design principles, models, methods, technological rules), to well-developed design theories about the phenomena under study at Level 3. Table 1 offers the products at the three levels and as earlier observed, whereas we have all the three level outputs, this paper reports on an aspect of the first level output.

Table 1: Design Science Research contribution types

Knowledge level abstraction	Contribution types	DSR Outputs
More abstract, complete, mature knowledge	Level 3: Well developed design theory about embedded phenomena	Design theories (mid-range and grand theories)
	Level 2: Nascent design theory-knowledge as operational principles/architecture	Constructs, methods, models, design principles, technological rules
	Level 1: Situated implementation of artefacts	Instantiations (software products or implemented processes)
More specific knowledge but at a practical level		

Source: Modified from Gregor and Hevner (2013: 342)

It is argued that design science research can be evaluated independent of the artefact or process where design research helps to offer evidence that the artefact is useful (Vaishnavi and

Kuechler, 2004). The artefact is evaluated to demonstrate its worth with evidence addressing criteria such as validity, utility, quality, and efficacy (Carlsson, 2010). Under their conclusion, Gregor and Hevner (2013) and as elaborated by Mullarkey and Hevner (2019) guide that any authors making a claim to a knowledge contribution need their design science research contribution focusing at methods, artefact description and evaluation (level one artefact evaluation). This study aimed at the following outcomes: artefact, methods, models, processes and design theory all documented within one participatory design science research framework as an enabler for e-government services among marginalized communities.

1.7 Location of the Study

This study draws on the Ugandan perspective concerning citizen requirements for design of e-government related applications therein forming citizen-to-government e-government solutions. Among the 127 districts, this study was conducted in Mukono District, which is simultaneously an urban, peri-urban and rural populace district within proximity of Kampala Capital City. An important consideration in respect of the location of the study is that of the policy environment. The Ministry of Information and Communication Technology (MoICT-Ug) and the targeted citizen projects and programmes within the Kampala Capital City Authority and corresponding peripheral district of Mukono informed the study. The choice for Mukono District was guided by the National Data Transmission Backbone that was planned to span 28 districts while the e-government infrastructure was to connect all government ministries and departments. Under Phase 1, Mukono District was one of the districts to be connected to the national backbone. Mukono District was specifically selected as a case study because it was a candidate pilot project for e-government infrastructure development. It is also in close geographical proximity to Kampala Capital City where most government ministries are located. Most e-government innovations and initiatives are rolled out to Mukono as a pilot district and therefore issues of access to ICTs and the internet were not a hindrance to this case study. These pilot projects include: mTrac, a short message service by the Ministry of Health; Mukono Information and Communication Center (MICC) targeting women entrepreneurs and their access to business information; establishing ICT clubs in secondary schools. Furthermore, within the National e-government focus, Mukono District was earmarked as one of the districts in Central Uganda to host the District Business Information Centers (DBICs).

1.8 Chapter summary and overview of the design science research process

From the foregoing background, the impetus for the study is premised in design science research paradigm and participatory action research design with participatory design as a methodology. Within participatory design are core concepts of co-design, empathetic participatory design and design thinking as crucial concepts that aid gaining insights into marginalized citizens’ lived realities. The research process of the study is presented below. Table 2 below presents an alignment of the primary research question to research sub-questions, methods, and research objectives based on four Design Science Research (DSR) phases (DSR1, DSR2, DSR3 and DSR4):

Table 2: Alignment Table of Primary Research Question and the Research Sub-Questions and Design Activities

Research question: Under what circumstances can a citizen-centric design approach address the design-reality gaps during e-government services application development, in a developing country context?				
Phase	Research Sub-Questions	Design activity: Method/s envisaged applicable to answer the sub-question.	Participants	Research objectives
	Sub-questions provide further structure, and generally follow a logical path through the research process: from literature review, to fieldwork, to analysis, and findings. The sub-questions collectively provide an answer to the primary question.	This provides an overview of how the study was conducted	This presents a unit of analysis for the research phases	This outlines the research objective for undertaking a given design activity.
DSR1	How does initial ideas generation take place during a participatory design process among citizens?	Exploratory discovery using open dialogues (formal and informal) to expand space for lots of different ideas to be discovered and shared. They included: FGDs, community consultations, observations	Community stakeholder group or sector representatives like health, education, SMEs	To establish the pressing citizens’ ideas that can be refined as problems for e-government service design purposes.
	What is the citizens’ status quo in regard to e-government (ICT) use and adoption in Mukono District, Uganda?	Survey and in-depth interviews.	Health sector citizens, citizens operating micro- and small businesses.	To examine citizens’ status quo in regard to e-government (ICT) use and adoption in Mukono District, Uganda.

DSR2	<p>How does problem discovery and scoping take place during a participatory design process among varied design team members?</p> <p>How does empathetic participatory design influence the shaping of the evolving artefact designed with a citizen-centric mindset?</p>	<p>Low fidelity prototyping: Drawing user scenarios based on the identified problems, using explaining texts, cartoons, stick drawings.</p> <p>Continuity with expressive user personae and paper prototypes.</p> <p>Develop stories that describe human activities or tasks.</p>	<p>Co-design team members as real designers, researchers and empathizing users, mimicking computers all performing as actors and users around the university community.</p>	<p>To examine how empathetic participatory design influences the shaping of the evolving artefact designed with a citizen-centric mindset.</p>
DSR3	<p>How in the design process does the profile of the citizen user and co-design team members influence the design outcome?</p>	<p>Persona development using low fidelity paper prototypes, roleplays (expressive user persona) through empathetic participatory design.</p> <p>Paper prototypes are used as communicating tools (props) during roleplays. Some form of internal usability testing using body storming.</p>	<p>Co-design team members as real designers, researchers and empathizing citizen users, mimicking computers.</p>	<p>To investigate how in the design process the profile of the citizen user and co-designers influence the e-government service design outcomes.</p>
DSR4	<p>To what extent does end user participation (citizens) and artefact simulation shape and inform the evolving design outcome?</p>	<p>High fidelity prototyping using Justinmind with simulation.</p> <p>Prototype presentations and evaluations in-house using the quantitative usability tool.</p> <p>Prototype presentations and qualitative evaluations among the community of users.</p>	<p>Co-design team undertake field simulation among citizens around the university community who have access to WiFi.</p>	<p>To assess the influence of end user participation (citizens) with artefact simulation on shaping and informing the evolving design outcomes.</p>
Framework synthesis	<p>How can the research and design processes be synthesized into a participatory design science research framework for reducing the design-reality gaps identified during the process for improving e-government services among marginalized communities?</p>	<p>Empathetic participatory design results corroborated with citizen users' artefact evaluation criteria viewpoint. Framework forms a point of convergence between co-designers and citizens.</p>	<p>Researcher</p>	<p>To synthesise the latter research and design processes into a design science research framework for marginalised citizens e-government application design framework.</p>

CHAPTER TWO

LITERATURE REVIEW

“Undertaking an extensive literature review helps to release the researcher’s imaginations and later on aids in reflective and critical thinking about the area of study,” (Hart, 2018).

2.1 Introduction

Whereas the fore going chapter has provided a background and context to the research problem under investigation, a review of prior relevant literature is an essential feature of any academic endeavour to release the researcher’s imaginations (Hart, 2018). By so doing, the researcher intended to provide a firm foundation for advancing knowledge, facilitate theory development, open and close areas where a plethora of research exists and uncover areas where the study can contribute. The literature review in this chapter is demarcated into three key sections as follows:

The first section provides the methodology of undertaking literature review, offers some concepts related to e-government and citizens and points to areas crucial to the study while in line with the major research question and study objectives. The same section offers an analysis of articles to generate the necessary theme for the study’s theoretical framework using a rhetorical move approach.

Section two presents the conceptual review showing the relationships of different concepts within the e-government literature and e-government situatedness within the information systems field. It maps e-government onto marginalised citizens, examining the conflicting perceptions of participation between citizens and government authorities to arrive at any potential design-reality gaps from available e-government applications. It further examines the citizens’ knowledge of e-government and e-government models to examine whether they align with participatory design. It further clarifies the notion of design-reality gaps and available attempts to bridge such gaps.

In section three, literature review based on study objectives is presented. Its aim is to identify and appreciate studies undertaken within the realm of participatory design of e-government for marginalised citizens. Particular emphasis is placed on identification of gaps that this study attempted to address. The literature helped the researcher to identify efforts that had been

undertaken so far to bridge the design-reality gaps for design of usable e-government applications for marginalised citizens as situated in prior works.

2.2 Methodology for Undertaking Literature Review

This section provides the methodology for conducting research using web-based tools and online databases. It highlights Boolean search operators used and the search results. Moreover, it illustrates the use of rhetorical move approach to undertake systematic literature.

2.2.1 General Overview and Methodology of Literature Review

This literature review was conducted via a search of libraries using UWC’s search and find link that connected to databases by subject, catalogues and google scholar. From database by subject, the main body of knowledge was Information Systems and the core databases searched were: ACM (Association of Computing Machinery) Digital Library, Emerald eJournals Premier , ScienceDirect, Wiley Online Library (1997 - 2015; core collection only) and Google Scholar and SCOPUS as the main databases. The literature searched was based on key words reflecting key dimensions of the study: human computer interaction, interaction design, participatory design, co-design, design-reality gap(s), e-government for marginalised communities and participatory design thinking. From the selected databases, all articles were saved in Mendeley Reference Manager by topical groupings based on the key words. However, to select these articles, Boolean operators presented in Table 3 below were used to generate pertinent articles.

Table 3: Literature Search Methods

Operator	Search results
[author: _____]	Returned results by author name
Published in:...	Journal published in a named journal
Year: [... TO ...]	Returned articles published within given range of years
OA-journal: yes	Search for Open Access Journal
Author: “Author... and Author...” AND published in:... Journal	Returns Authors and Publication Journal
Author: “Author and Author” AND published-in: OR published-in: Journal	Returns Authors and Publication in either journal...or journal.
[“...”]	Returns articles based on ALL key words given ELSE it would return articles containing ANY of the words.

2.2.2 Analysis of Articles to Generate the Necessary concepts to underpin the study

To manage the large volume of articles emanating from the multidisciplinary of the study, the researcher exported the articles from Mendley reference manager to Atlas Ti 8.0 to generate open codes as a basis for grounded theory data analysis. These articles had been saved in Endnote Extensible Mark Up Language (XML) ready for qualitative analysis. Literature argues that Endnote XML contains no ambiguity, and thus allows attachments to carry over quickly. Key methods of undertaking this literature review was by rhetorical move approach (Table 3) coupled with retroduction and abduction developed by Peirce (1957). While a number of scholars use the two concepts interchangeably (Mingers, 2004; Kovács & Spens, 2005), I argue they are different as noted.

As Meyer and Lunnay (2013) opine, using deductive inference, the theoretical lens is proved or disproved, leaving findings that lie outside the initial theoretical mould unanalysed. However, abduction allows the researcher to formulate new ideas and think of something in a different context in order to see something else (Danermark *et al.*, 2012). Unlike abduction, retroduction allows the researcher to move beyond the conceptual apparatus and begin to question and clarify the basis of prerequisites or conditions for priori assumptions or theoretical frameworks (Meyer & Lunnay, 2013). Tsang (2014) notes that retroduction aids critical realists to generate mechanistic explanations – the researcher takes some unexplained phenomenon and proposes hypothetical mechanisms that, if they existed, would generate or cause that which is to be explained. Details of abduction and retroduction is elucidated in the theoretical underpinning subsequent chapters.

To that effect, literature takes a dense, deep and broad analysis of available knowledge bases. Similar to abductive and retroductive explanation, scholars have popularized notion of rhetorical moves to undertaking literature review (Fazilatfar & Naseri, 2014: 495). Rhetorical moves is a top-down approach to analyzing the discourse structure of texts from articles: the text is described as a sequence of “moves,” each move representing a stretch of text that serves a particular communicative function (Pho, 2008: 16). In this study, the process involved coding

and analyzing literature by asking questions such as who, why, how, why this way and when?, throughout manuscript sections.

As regards to current viz-avis outdated literature review as contradicted by several authors, this study adapts and adopts other researchers who suggest that organizations can create competitive advantage through acts of innovation, entrepreneurship, and organizational renewal by searching for, accessing, and using knowledge created at different points in the past, a process known as temporal search (Katila, 2002; Katilan & Chen, 2008; Argyres, De Massis, Foss, Frattini, Jones & Silverman, 2020).

For instance, Minnesota Mining and Manufacturing Company (3M) radically innovated the flexible circuit business with 3M Flex, a solution developed by using technologies the firm had almost abandoned in the 1980s (Christiansen, 2000). Similarly, the world-leading Danish hearing aid manufacturer, Oticon, saved itself from bankruptcy by developing the Multifocus hearing aid, which was based on much earlier breakthroughs the companies had shelved years before (Foss, 2003).

Reviewing historical work, which is termed as outdated and needs to be discarded is one way of effective strategy scholarship wherein such history and historical research methods can enrich theoretical explanations of strategy phenomena (Argyres, et al., 2020). From such discussion, the literature review based on Rhetorical Move Approach considers both historical and current literature to seek for a more feasible alignment of findings that can aid the development of a citizen-centric e-government participatory design framework.

Table 4 below was used to examine the variables that can form literature review constructs of the study using the rhetorical move approach summarized.

Table 4: Rhetorical Move Approach

Research Article Structure (RA)	Moves Structure	Explanation of Moves
Introduction	Move 1: Background information	A. Reference to established knowledge
		B. Reference to main research problem
Literature Review	Move 2: Reviewing related research	A. Reference to previous research
		B. Reference to limitations of previous research
	Move 3: Presenting new research	A. Reference to research purpose
		B. Reference to main research procedure
Methodology and methods	Move 4: Data collection procedure A. Indicating source of data B. Indicating data size C. Indicating criteria for data collection	A. Indicating source of data
		B. Indicating data size
		C. Indicating criteria for data collection
	Move 5: Experimental procedures	A. Identification of main research apparatus
		B. Recounting experimental process
		C. Indicating criteria for success
	Move 6: Data analysis procedure	A. Define terminologies
B. Indicating process of data classification		
C. Identifying analytical instruments/procedures		
D. Indicating modification of instruments		
Move 7: Indicating consistent observation	A. Highlighting overall observation	
	B. Indicating specific observation	
	C. Accounting for observations made	
Results	Move 8: Indicating non-consistent observation	Indicate non-consistent observation
	Move 9: Highlight overall research outcomes	Highlight overall research outcomes
Discussion	Move 10: Explaining the specific research outcomes	A. Interpreting the outcomes
		B. Indicating significance of outcomes
	Move 11: Stating research conclusions	A. Indicating research implication
		B. Prompting further research

(Source: Researcher modified from Pho, 2008: 16; Fazilatfar & Naseri, 2014: 495)

Papers referenced in the reference manager (Mendeley) were subjected to the next level assessment (rhetorical move approach) as a pure qualitative data analysis. They were then analysed using Atlas Ti to generate open codes and preliminary code categories and memos. From there, focused literature was undertaken using coding word per word and line for line for candidate articles scoring high in the rhetorical move approach. It is at this point that core and sub-categories for framework constructions were generated. This resulted in the sub-topics that formed the basis for detailed literature review.

2.3 Review of Core Concepts

This section aims to show the relationships of different constructs and concepts that the researcher sought to investigate. These core concepts are in line with the overall study rationale that points to e-government issues for marginalised citizens. The foundation for review of core concepts to identify high-level design-reality gaps was premised in socio-technical theory and information systems design science research theories. Many studies have analyzed e-government literature as a whole or a specific area to focus on statistical methodologies, lessons learnt, or problem related to the area. However, limited investigations from socio-technical perspective on e-government issues, in developing countries, have been carried out (Khan, Moon, J Park, Swar, & Rho, 2011; Gibreel & Hong, 2017). Utilizing socio-technical approach, the researcher analyzed and synthesized e-government literature that deals with the issues/topics in developing countries from the lens of socio-technical theory (STT) (Bostrom & Heinen, 1977) and Information systems design science research theory (ISDSRT) (Carlsson, 2006) and theoretical lenses. The design theory argues that any Information System study like e-government is a socio-technical discipline and that design science research must acknowledge that design is fundamentally a human activity. Socio-technical theory espouses that during analysis of literature, focus is placed on the problem and the formulation of the design process in joint consideration of the technical system requirements and the social system requirements (Bostrom & Heinen, 1977; Carlsson, 2006; Gibreel & Hong, 2017). The concepts reviewed are:

- E-government situatedness
- Taxonomy of e-government
- Stakeholder engagement into design process and associated challenges
- Marginalised citizen characteristics

- Conflictinmg perceptions of participation between citizens and their government during e-government deployment
- Design-reality gaps

2.3.1 E-Government Situatedness

E-government studies lie between the fields of public administration and information systems. As earlier noted, reinvention of federal governments with the aim of having governments work better and providing results citizens care about has been important to many countries (West, 2004). However, most e-government studies are broad in nature without a focus on citizens, especially the marginalised. Such studies are mainly focused on the technological aspect of e-government (Gibreel & Hong, 2017). Nonetheless, examining the social, technical and socio-technical dynamics that are interconnected within the development of e-government is crucial to understanding both early stage and evolutionary stage prerequisites of such interventions. Moreoever, at the back of the researcher’s mind during interrogation of literature review, is not a single theory but multi-focal theoretical lenses from ICT4D theories, adoption theories, e-government NPM theory, capabilities theory as is applicable within socio-technical theoretical frameworks. Figure 3 below presents the nexus of technical, socio-technical and socio-development dimensions of IS designs:

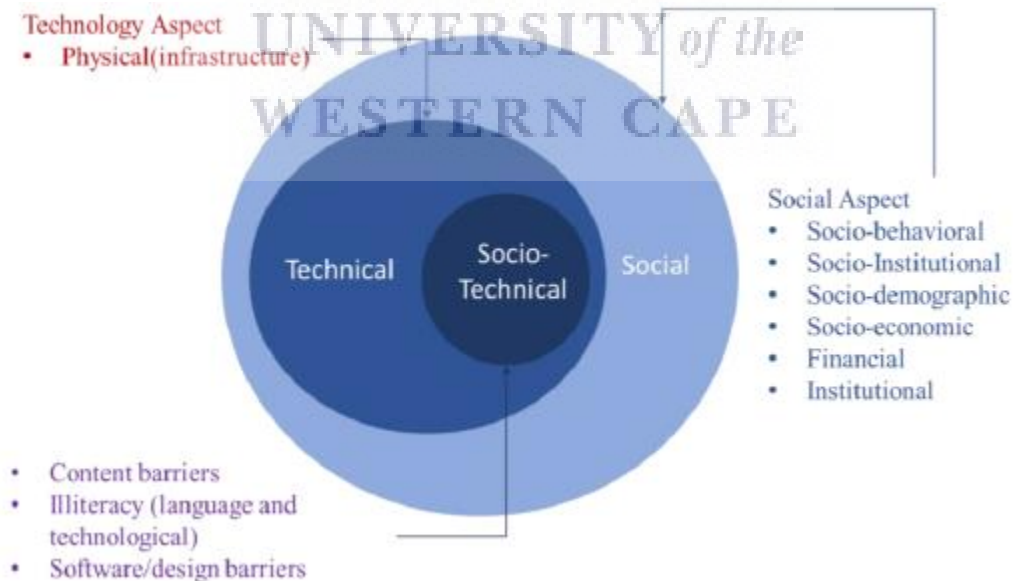


Figure 3: Information Systems Dimensions,

Source (Gibreel & Hong, 2017)

Due to the nature of governance and how it influences the daily life of citizens, it is important to examine the development of these systems from a holistic and open participatory approach (Lee-Geiller & Lee, 2019). A related citizen concern is revealed by Bannon and Ehn (2012), who noted that participatory intervention design originated from the push of workers to have more democratic control and autonomy in their work. This democratic control has its roots in Public Management Democratic Principles. Similarly, citizen-centricity has its roots in the New Public Management (NPM) that originated in the 1970s in the United Kingdom, Australia and New Zealand (Hood, 1991). While the notion of NPM is not the core of this literature, it is critical when examining the need for citizen participation. NPM emerged as a result of challenges like fiscal crises of governments, poorly performing public sectors in different arenas, authoritative bureaucracy, lack of accountability, corruption, changes in people's expectations and the emergence of better forms of service delivery (De Vries & Nemec, 2013).

In the views of NPM, citizens cannot be treated as customers (as if they are there to purchase the business's product because they have no other options) but they can be part of the building of that product. They argue, they deliberate, they deconstruct, and they co-create (Holmes, 2011). Holmes further asserts that in a republic, the state is owned by the citizens, and the task of governance is a collective enterprise in which all citizens are invited or even obliged to take part in affairs that concern them (Resnikoff, 2015). Citizens are no longer seen as a mere target but as agents at the centre of policymaking and service design. There is therefore a need to harness public management principles from the e-government literature and the socio-technical literature. This informs socio-technical theories discussed later in this thesis.

As noted earlier, the reason for benchmarking with public administration literature is that e-government includes components of government, politics and information systems (IS) and therefore the interplay of such disciplines is critical. From a public administration point of view, it is asserted that poorly performing governments were not being held to account and were irresponsible to their beneficiaries while competing with a private sector that was increasingly customer-oriented. Such a competitive atmosphere called for customer-oriented, result-driven and enterprising governments. NPM emphasized the need for modern bureaucracy, with no traditional red tape, so as to reinvent government and change its role from 'rowing' to 'steering' (Sarker, 2015).

From the foregoing debates, it is observed that NPM paradigm should put forward a different relationship between governments, the public service and the public for effective public service delivery. Several authors contend that the NPM does not suit developing countries since governments in these countries lack the expertise and have unreliable information systems (Islam, 2015) for which e-government deployment could be the solution. Elvira, Popescu, Nicolăescu and Constantin (2014) observe that in developing countries, e-government through the use of information technology to transform government, the potential for online government information to contribute to citizen engagement, and the rapid growth in local government use of social media is a viable solution to NPM challenges. Similarly, since reinvention of government is driven and linked to the proliferation of information technology (Ochara & Mawela, 2015), there arose e-concepts like e-learning, e-commerce, e-business, e-government and e-governance (Al-Hujran, Al-Debei, Chatfield & Migdadi, 2015; Kumar, 2015; Twizeyimana & Andersson, 2019).

2.3.2 Taxonomy of e-government

This section offers a categorisation of e-government based on varied perspectives. For example, Linders (2012) categorized citizen e-government-based ‘provider versus beneficiary dimension’ as government-to-citizen and citizen-to-government collaborations. Alsaghier, Ford, Nguyen and Hexel’s (2009: 296) taxonomy of e-government relates to citizens’ appreciation and uptake of e-government. In regard to citizen interaction with e-government, the latter has been categorized for use as *information publishing*, described as the basic form of e-government where government posts information through the internet on official websites, improving transparency; *two way communication* where citizens communicate with government through the internet and make simple requests that are sent to the requester by mail or email; *transaction* where citizens can transact business fully online like renewing a driving license and filing tax returns among others; and *integration* where government services are provided from different departments and agencies, all integrated and accessed through a single website referred to as an ‘e-government portal’ (Alsaghier, Ford, Nguyen & Hexel, 2011). The literature reviewed describes the e-government stages as e-government maturity models. They help governments, evaluators and designers to position where the project fits in the overall evolution of an e-governance strategy.

(Reddick, 2005; Andersen & Henriksen, 2006; Alsaghier *et al.*, 2009). Other authors have referred to the categorization as models as summarized in Table 5:

Table 5: Existing Models of e-Government

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Joshi & Islam, 2018	Basic services (Awareness and trust by citizens)	Streamlined services (Citizen know-how)	Transaction services (Agile accessibility) and design	Services automation (Involvement)		
United Nations 2001-2008		Emerging presence and enhanced presence	Interactive presence	Transactional presence	Seamless presence (2001) Networked presence (2003, 2005), Connected (2008)	e-participation index (2003, 2005, 2008)
Reddick, 2004		Catalogue	Transact			
Howard, 2001	Publish	Interact	Transact			
Lyne & Lee, 2001		Catalogue	Transact	Vertical Integration	Horizontal integration	
Hiller & Belanger, 2001		Information dissemination	Two-way communication	Integration	Transaction	Participation
Wescott, 2001	Email and internal network	Interorganizational and public access to information	Two-way communication	Exchange of value	Digital democracy	Joined up government
Baum & Di Maio, 2000		Presence	Interaction	Transaction	Transformation	

While all these models critique one another due to inherent limitations such as e-government assimilation as occurring in a linear pattern, this is not always the case. The naming of these models has received criticism due to contradictions concerning whether all countries go through them in a linear style (Joshi & Islam, 2018).

These models are based on the modernization and dependency views (Henningsson *et al.*, 2010). Modernization perspective holds that all societies progress through similar stages of development, that today's underdeveloped areas and individuals are in a similar situation to that

of today's developed areas and individuals at some time in the past (Ferraro, 2008). This scenario argues that the task of helping the underdeveloped out of poverty is to accelerate them along a supposed common path of development, by various means such as investment, technology transfers and closer integration into the world market in a linear manner. However, a question that remains unanswered is the extent to which citizens are aware of such stages and how they are to engage with government at a given stage if the designs take a techno-centric approach. There is dire need to examine the citizen characteristics as this may help build context-based e-government designs by examining their participation levels and sufficiency (Fuller *et al.*, 2009; Laurillard, 2013; Twizeyimana & Andersson, 2019).

Review of e-government maturity models can be used to provide guidance and guidelines to identify those best practices that can be applicable for design of citizen-centric e-government applications for developing contexts (Waziri & Yonah, 2014). However, such models come with critiques and require careful context based use (Bayaga, 2020). These include a lack of sound theoretical base (Renteria, Gil-Garcia & Pardo, 2019); they are good for implementation of a one-stop shop (Scholta, Mertens, Kowalkiewicz & Becker, 2019) which may not be very applicable for the marginalized context in this study. The section below highlights the juxtaposition of e-government for citizens in a marginalised setting.

2.3.3 Notion of Marginality and Marginalization

This study's focus is design for citizens in a marginalised context. Whereas citizens exist at various levels of government, the focus of this study is on citizens in a marginalised setting. This section unpacks the concept as determined by context. It also highlights issues related to marginality and marginalization to ensure a proper understanding and situatedness of the study participants.

Mukherji (2018) conceptualizes *marginality* as an adverse state or condition of existence of individuals and groups in a relation of subordination or inferiority to others who are at the 'centre' or 'mainstream'. The marginal person or group of people in that state or condition involuntary margins of social, political, technological, economical and biophysical systems that prevent them from access to resources hence keeping them in underdevelopment (Pelc, 2017). In

the event that there is no marginality, there can be centrality. *Marginalisation* is the process by which the condition of marginality is reached (Collins, 2010). Whereas marginality has been rooted in cultural and structural contexts (Viruell-Fuentes, Miranda & Abdulrahim, 2012), new forms have been linked to social exclusion, digital exclusion or digital divide (Warren, 2007; Burns, Blanchard & Metcalf, 2010). Marginality exists where there is some feeling of dual personality. For example, Stonequist (1937), in a study entitled *The Marginal Man*, drew attention to the cultural conflict the marginal man experienced following prolonged cultural contact, contributing to the emergence of the “personality type”. Similarly, Billison (2005) redefined the *marginal man* as poised in psychological uncertainty between two (or more) social worlds; reflecting in his soul the discords and harmonies, repulsions and attractions of these worlds, one of which is often ‘dominant’ over the other. Within such a system, membership is implicitly (if not explicitly) based upon birth and ancestry (race or nationality) and where exclusion removes the individual from a system of group relations.

From such debates and similar theoretical foundations, this study conceptualizes marginalised citizens as those in the digital divide with economic and social challenges; they cannot use technology if they have no access to it. They may have access to different forms of digital centres (e.g. telecentres), but no usability. They are in technological disorientation and exclusion due to economic, cultural, structural and social contexts. An understanding and working with the marginal person living within two worlds enables him or her become a creative agent (Goldberg, 2012), building capability approaches of well-being (Sen, 1990) and affordances (Conole & Dyke, 2004; Hammond, 2010). Such a scenario of marginalised citizens living in two worlds could thus result in conflicting perceptions regarding their participation with government authorities.

2.3.4 Stakeholder engagement and its associated challenges

Involvement of stakeholder into design of e-government results into greater public value (Twizeyimana & Andersson, 2019). The e-government stakeholders include the government (ministry/agency), technologically-advanced country, companies and users (citizens) (Kyakulumbye, Pather & Jantjies, 2019). The stakeholders’ roles and tasks vary from ‘pre-implementation’ (initiation) to ‘during implementation’ (planning and implementation), and

'post-implementation' (monitoring and evaluation) phases of e-government applications (Ashaye & Irani, 2019). Moreover, involving all citizens as a design for all strategy or inclusive design would be another key gain from universal stakeholder involvement (Bonacin, Dos Reis & Baranauskas, 2019). In terms citizen-centric e-government design, citizens at the core of the application and this imply that universal involvement of all categories of these stakeholders need to be realized. From literature reviewed, a number of challenges are highlighted that make it impossible to involve all stakeholders affected by an e-government application design process. For instance, Chemisto, Rivett and Jacobs (2016) summarize the following challenges:

- Involving all relevant stakeholders was difficult because matching meeting dates was nearly impossible
- Decisions made in absence of some participants becomes thorny if they don't agree with them later
- A lot of time is spent selecting participants willing to meaningfully participate
- Language barriers. Although a translator can be employed throughout the research duration, much is lost in translation.
- Finding appropriate ways to reward participants in order for them devote their time is also a challenge
- Financial costs with regards to scheduling/ re-scheduling meetings and recompensing participants
- A lot of time is spent coordinating stakeholders and holding meetings and these all affect the project duration. Participatory design obliges time and resources, requiring commitment and flexibility. of researcher

According to principles of participatory design, a genuine democratic process requires effective participation of all stakeholders in the design process. However, among the identified challenges, literature on stakeholder engagement underscores why such engagements have been so unsuccessful in the past. The most impediment emanates from the conflicting perceptions on participation levels between the citizens and their governments (Rose, Persson, Heeger & Irani, 2015). For instance, To citizens, governments appear to fail to completely play their role of generating public value among citizens (Fröhlich & Peters, 2017) and this escalates the conflicting perceptions between the two stakeholders. The next section examines these

conflicting perceptions to details to identify how inclusive participatory design can be undertaken (Bonacin, Dos Reis & Baranauskas, 2019).

2.3.5 Conflicting Perceptions on Participation between Citizens and Government Authorities

E-government involves and requires a number of stakeholders engagements. Pertinent to this study are the citizens as potential users of the systems, the designers, the government authorities and their associated agents. However, e-Government initiatives often suffer from complexity, vision failure, lack of goal clarity and insufficient commitment due to diverse stakeholder expectations (Rose, Persson, Heeager & Irani, 2015), especially among the citizens and the government authorities resulting into conflicting perceptions (Bataneh & Abu-Shanab, 2016; Ruhode, 2016). Citizens and government authorities appear to exist in two different worlds, yet in reality we are in the same country on the same planet (Bennett, Wells & Rank, 2009; Clarke & Margetts, 2014). That being said, government authorities have the ability of existing in the citizen world whereas typical citizens may not be in a position to visit the world of government officials (Bennett, 2008; Zavattaro & Sementelli, 2014.). This ontological stratification is real and cannot be denied (Yang, 2015). Therefore, this is likely to result in sense of identity based on the locale continuum that may yield conflicting perceptions between the two (Kim & Kim, 2003; Zavattaro & Sementelli, 2014). These could influence design outcomes, and under this section, literature related to such a conflict or non-conflict is reviewed.

Notably, there is a growing consensus among citizens and members of local government that citizen participation is desirable for local government (Ebdon & Franklin, 2006; Fung, 2015). However, in practice, there are differing perceptions between them regarding the level and extent of citizen participation. As citizen participation is a multi-faceted concept, its meaning is construed differently by both the members of local government and citizen groups (Mohammadi, Norazizan & Nikkhah, 2017). Even at a citizen or government authority level, there are varying perceptions in regard to participation for different individuals and interest groups. However, such stratified meanings need to be well harmonized if co-design between citizens and governments is to take a successful route. The ambition to reveal those conflicting perceptions is at the heart of this section. Then where does the conflict lie? Roberts (2004: 315) reveals in his paper entitled '*Public deliberation in an age of direct citizen participation*' a dichotomy of two perception

issues relating to participation: people-centred (PC) view or direct participation and authority-centred (AC) view. This poses conflict where the local government authorities at the heart of implementing e-government may be struggling to influence the decision process (Choudrie, Zamani, Umeoji & Emmanuel, 2017).

Whereas the central issue is about power and the ability to exercise power over the other, the proponent of a PC perspective holds that it is the people who have the right to determine their lives in their own locality, and therefore it is their role and obligation to actively participate to decide for themselves (Martin & Mirraboopa, 2003; Thompson, 2007; Mohammadi *et al.*, 2017). On the other hand, various authors like Roberts (2004; 2015) and Dzur (2004) reveal that direct citizen participation is viewed with scepticism and even wariness among local authorities. Such scepticism is a precursor to the fear of shared responsibility between the government authorities and their citizens. Direct people participation into affairs of their own has been summarized as being “developmental”, “educative”, “integrative”, “legitimizing”, “instrumental” and “realistic” that enables people to be their own masters, and it ensures that no person or group is the master of the other (Mohammadi *et al.*, 2017). The nature and magnitude of perception of conflict predicts the divisions of power which determines the level of participation from grass roots (people-centred view) to authority-centred view (instrumental participation) (Silverman, 2005). In summary, various authors discuss citizen participation in the context of grassroots organizing, arguing that true participation stems from the development of indigenous leadership, community-led initiatives, and confrontational tactics (Alinsky, 1969 cited by Silverman, 2005: 38). Yet such community-led initiatives have been recommended as key to building a community social capital as everyone would be better off if everyone could be given a chance to cooperate (Putnam, 1993; Makonese & Bradnum, 2018).

However, general local government authorities view typical citizens as occasionally selfish with their focus limited to short-term personal gain rather than long-term community interest (Yang, 2006; Mohammadi *et al.*, 2017). For instance, Yang (2006) examined the relative importance of administrators’ trust in citizens, trust in participating institutions, and propensity to trust in explaining their willingness to involve more citizens in public decision-making. The results show that administrators’ trust in participating institutions is a mediator between trust in citizens and administrators’ promotion of participation activities.

On the other hand, Kitschelt (2000) highlights a conflicting issue from the political point of view called “*clientelism* [elected politician perceives those who elected him/her as his/her/my people]” (p. 852). It is caused by alternative voter-elite linkages through the personal charisma of political leaders and, more importantly, selective material incentives in networks of direct exchange for votes (Cooper, Bryer & Meek, 2006). This implies that incorporating people participation into ongoing operations is a strenuous challenge and perceives a cause of conflict among local government authorities – especially when it comes to issues of perceived threat to power and trust among other variables. Similar to clientelism is the concept of totalitarianism, where the state recognizes no limits to its authority and strives to control every aspect of the public and private life wherever feasible (Oi, 1985; Geyer & Fitzpatrick, 2009).

While the extensive networks involved in clientelism suggest that this informal governance may yield more participatory tendencies among citizens, authoritarianism or totalitarianism-clientelism may not lead to democratic outcomes because it undermines citizen participation (Oi, 1985; Jusufi, 2018). There is a need to be aware of such conflicts arising among any participatory endeavours as it undermines the quality of development interventions. Failure to involve the end users into the design of applications that address their pressing needs is what this study refers to as design-reality gaps.

2.3.6 Design-Reality Gap(s)

Design-reality gap (s) is the difference between the current reality and the design proposal for the new e-government project (Heeks, 2001). Whereas Heeks refers to a design-reality gap, there are several design-reality gaps in e-government design for marginalised citizens that result into successes or failures (Masiero, 2016). Heeks (2003) notes that central to e-government success and failure is the amount of change between “where we are now” and “where the government project wants to take us as citizens”. The success or failure of e-government depends on the size of the gap that exists between the current realities and the design of the e-government project (Heeks, 2003). Whereas Heeks points out ITPOSMO (Information, Technology, Process, Objectives and Values, Staffing and Skills, Management Systems and Structures, Other Resources: time and money), these seem to be general dimensions in the e-government categorizations that provide variation to the design-reality gaps. Heeks himself highlights in later papers that the Design- Reality Gap only captures part of the challenges e-Government

implementations and this aspect is sorely missing in the discussion. Whilst the Design-Reality Gap is an interesting framework, it is not a theory that assists in explaining the success and failures of e-Government implementations (Gómez & Heeks, 2016).

Drury (2005) devised the 5C Model – context, content, connectivity, capacity and community. Sigwejo and Pather (2016), in their e-government user-centric satisfaction framework (ECSF), summarized them as functionality of service, motivation to use service, enabling infrastructure and government preparedness. The first two, functionality of service and motivation to use it can be directly linked to users. Choi *et al.* (2016) also took a design-reality perspective and adopted a STOPE framework (strategy, technology, organization, people and environment) and AHP framework (analytical hierarchy process) to bridge the gap between theory and practice. To bridge the design-reality gaps, the focus of this study is on user-centric design as the solution to the theory-practice inconsistencies in information systems research.

From an African perspective in Rwanda as a case, Bakunzibake, Grönlund and Klein (2019) have observed that gaps related the harmonization of policies among agencies and, from a management point of view, requiring coordination, calling for political support still exist. Moreover, the design-reality gap analysis of e-government has been under critique as there are several other gaps that warrant to be addressed. For instance, Knox and Janenova (2019) have noted that ITPOSMO have observed that the transactional services are faster within the model have instead displaced attention from core public services that call for greater participation by citizens into e-government development. Similarly, Oyerinde and Bankole (2020) use of ITPOSMO in its narrow perspective offers evidence of the gap between citizens' expectations and enhancing the services for all. In this thesis, the researcher offers support for literature that design-reality gaps tagged onto to ITPOSMO need to be used in consideration of the constructs within but needs a more broader perspective. Heeks himself highlights in later papers that the Design- Reality Gap only captures part of the challenges e-Government implementations (Heeks, 2009; Guha & Chakrabarti, 2014. Choi, Park, Rho & ZO 2016). Among the challenges within the design-reality gaps, are issues related to participatory design and co-design.

2.3.7 An elucidation of participatory design and co-design concepts

Since this is a design related study, two key concepts that need to be discerned with literature prior to addressing literature related to study objectives are participatory design and co-design. Participatory design has been used in literature to encompass co-design and empathetic design and it has been subject to analytical scrutiny resulting in different distinctions (Bossen, Dindler & Iversen, 2012). Yet in a similar context, participation, on its own can be controversial, which most often focuses on the concerns of end users. Other distinctions concern type of participation for example direct participation by end users, indirect participation by user representatives or empathetic and imagined representation (like the persona type) (Bossen et al., 2012; Peterson, 2016). Even in direct participation, there is concern of degree of participation whether users are involved as test subjects; as in the testing of the design proposals; as sources of information relating to work practices; as cooperative design partners; or as cooperative project partners who make decisions regarding not only design but also regarding project directions (Sanders & Simons, 2009; Bossen et al., 2012). This then implies that the evaluation of participatory design work need to be clearly demarcated before drawing conclusions that may be out of context (Donetto, Pierri, Tsianakas & Robert, 2015). From my study context, the kind of people who participate, the type of participation and degree of participation were the determinants of design contexts conceptualization viz participatory design, co-design and empathetic participatory design.

Davis (1993), in his research made a conclusion that there is a need for mechanisms by which design choices influence user acceptance within applied contexts. This proposition still has merit today and is premised in participatory design approaches. The community informatics literature reveals that with the design of applications, projects and activities within a community informatics framework that would be most supportive of *effective use* for grassroots communities, would be participatory design (Gurstein, 2003). Participatory design is a well cited strategy (Qureshil, Kamal and Wolcott, 2009; Wyche, 2015) and several fruits have been documented to date in respect of its application. It is a methodological approach that recognizes that ideas develop slowly over time, and can help discover confounding demi-regularities (Lawson, 1997) called contextual factors. It could also mitigate pre-usage beliefs and attitudinal expectations and helps to clearly understand negative generative mechanisms that could affect

adoption (Van Aken, 2005; Andriessen, 2006; Jagosh, *et al* 2012). The section of literature review was used to guide my decisions for this conceptualization:

Table 6: Key references of participatory design and co-design approaches compared

Concept (s)	Authors	Description and conceptualization
Co-design No participatory design mentioned	Chemisto, Rivett & Jacobs, 2016	Co-design enables active involvement of users in the design process
Co-design and participatory design	Donetto, Pierri, Tsianakas & Robert, 2015	Drawing upon participatory design principles, the co-design element aims at opening up the boundaries of designing in services in order to include new stakeholders and forms of expertise; patients are called to share their specialist form of expertise (knowledge) and participate in the design process from the idea generation stage. Participatory design gives primacy 'to human action and people's rights to participating in the shaping of the worlds in which they act', where participation refers to 'the fundamental transcendence of the users' role from being merely informants to being legitimate and acknowledged participants in the design process'
Participatory design No co-design mentioned	Bossen, Dindler, & Iversen, 2012	More ambitious conceptualization of PD as respect for users regardless of status and recognized as prime sources of innovation; while a modest a more realistic conceptualization of PD is the development of tools and techniques that facilitate communication and learning processes between users and designers,
Participatory design	Leong, & Robertson, 2016	PD involves use of tools, methods and participation as means to work with participants' values imbedded during the design process.
Participatory design in form of empathetic user design	Peterson, 2016	Empathetic user design is an approach to design of communication to meet the experiences of users and their feelings as related to the experiences. It is empathetic as it highlights the importance of designers understanding an audience by living through common experiences of facing the same challenges with usability.
Participatory design and co-design	Barcellini, Prost & Cerf, 2015	PD is a form of collaborative design or co-design activities occurring in design meetings and participatory design situations. This implies that co-design is part of PD and the extent of who collaborates is subject to context of use.
Participatory design, co-design	Mariesa, el al., 2012	PD are methods which put central focus on creating conditions for design stakeholders to participate in the design process regardless of their design skill or background. To implement the participatory design process, the authors used co-design workshops with the beneficiary youths. To implement co-design workshops, the teams undertook empathy design through persona to build scenarios for their fellow youth going through the same uninterested challenges.
Participatory design, co-design and empathetic participatory design	Kyakulumbye, et al., 2019 & the entire unpublished thesis	Co-design was derived from prefix 'co' meaning subordinate and 'design.' Is when the study conducted among the design team members as subordinates to the principle investigator, taking and switching roles of designers and users, not necessarily with participatory activities. Or a process of running an innovation project in which a variety of actors are used to work on a shared solution.

		<p>Empathetic participatory design was conceptualized as sharing methods and reflections of designing 'with' and 'for' empathy through practice design activities and switching roles as users and designers.</p> <p>Participatory design is a design methodology when end users are integrated into application development (prototyping and artefact design). Or a high participative mobilization of a variety of individuals, especially the public and developers work iteratively together for breakthrough innovations that meet their needs. Participatory Design stresses more the involvement factor.</p>
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From the above debates, the concepts will be used as follows: From prefix ‘co’ meaning subordinate and ‘design.’ Is when the study conducted among the design team members as subordinates to the principle investigator, taking and switching roles of designers and users, not necessarily with participatory activities. Or a process of running an innovation project in which a variety of actors are used to work on a shared solution. Co-design leans more on teaching the skills to the recipients of the process. Participatory design is perceived as a design methodology when end users are integrated into application development (prototyping and artefact design). Or a high participative mobilization of a variety of individuals, especially the public and developers work iteratively together for breakthrough innovations that meet their needs. Participatory Design stresses more the involvement factor. The next literature relates participatory designers and co-designers within the design research process. Citizens form part of the participatory design team. The next section reviews literature in relation to the study objectives prior to undertaking concepts associated with e-government, marginality and design-reality gap.

2.4 Literature Review Based on Study Objectives

This section examines the available knowledge to assess any intellectual endeavours that have been published in efforts to further understand how the design-reality gaps, during e-government services application development, can be addressed in a developing country context. The literature review herein sought to respond to the following research objectives:

- a) Examine the citizens’ status quo in regard to e-government (ICT) use and adoption
examine the citizens’ status quo in regard to e-government (ICT) use and adoption.
- b) Investigate how, in the design process, the profile of the citizen user and co-designers influence the design outcome.

- c) Review the available participatory design science research frameworks and models aimed reducing the design-reality gaps for improving e-government services among marginalized communities.
- d) Examine how problem discovery and scoping takes place during a participatory design process among varied design team members.
- e) Examine how empathetic participatory design influences the shaping of the evolving artefact designed with a citizen-centric mind-set.
- f) Assess the influence of end user participation (citizens) and artefact simulation on shaping and informing the evolving design outcomes.

2.4.1 Citizens' Status Quo in Regard to e-Government (ICT) Use and Adoption

E-government implementation in developing countries is always less successful and objectively hard to achieve and the reason behind is a less citizen-centric approach (Asmi, Zhou & Lu, 2017). From such a human-centric assertion, authors observe that trust and social influence are of impact on the intentions of citizens to use and adopt e-government (Bell & Nusir, 2017). Yet, Alzahrani, Al-Karaghoul and Weerakkody (2017) reveal that citizen's aspects of trust (such as personality, culture, gender, experience, education level, beliefs and value systems) call for government agencies to consider some strategies to empower their citizens and increase their awareness about e-government systems.

Similarly, Lee, Kim and Ahn (2011, 228) argued that the willingness of citizens to adopt e-government depends on the perceived quality of government services through traditional brick and mortar service channels (offline service channels), and the level of trust they place in the internet technology itself. This is because the roles of citizens include taxpayers, customers and political constituents to whom the government is accountable through various political processes (such as voting). In Libya, Abdulghani Abdulsalam Abied (2017) observed that launching e-government services in ease to use manner, providing services that are centred around the need for the users, identifying to citizens the advantages of using e-government services were an alternative to other means of interacting with its government agencies. Moreover, launch efforts to increase Information Technology literacy, provide people with required resources to use e-government played a facilitating role in unlocking the status quo. Another precursor for citizens'

status quo regarding e-government use is reliance on the perceived benefits and risk shaped by their personal experience, beliefs, and general attitudes (Norris & Moon, 2005; Srivastava & Teo, 2005; Lee *et al.*, 2011; Ejdy, Ginevicius, Rozsa & Janoskova, 2019). Such cognitive constructs have been addressed in the adoption theories that will be reviewed in the theoretical framework chapter that follows.

Considering government websites as initiatives for information access, web accessibility and usability affect effectiveness and efficiency of web usage (Asiimwe & Lim, 2010; Paul & Das, 2019). The primary focus of web accessibility by citizens is elements of learnability, memorability, effectiveness, efficiency and satisfaction for all website users (Henry, 2002; Kureerung & Ramingwong, 2019). These result in the extent to which citizens are willing to adopt and use web application services set forth by governments as e-government endeavours. This is because usability aims at satisfying the users – and why users’ cultural contexts are considered when designing usable websites (Hillier, 2003; Kureerung & Ramingwong, 2019). In all, “accessibility is a subset of a more general pursuit: usability” (Henry, 2002: 1; Bai, Grzeslo, Wang, Min & Jayakar, 2019), because websites may be technically accessible but hard to use. Since accessibility is a subset of usability, usability represents an important aspect in the development of government websites. For instance, in Uganda, a study of four government websites by Asiimwe and Lim (2010) and Nakatumba-Nabende, Kanagwa, Kivunike and Tuape, (2019) report low usability of websites due to design-related issues, especially in terms of ensuring that government meets the web accessibility needs of the marginalized citizens.

In regard to marginalised citizens, technology type could result in variations in adoption and status quo (Nakatumba-Nabende *et al.*, 2019). However, what is missing in the body of knowledge is a critical analysis of the underlying characteristics of the technology that can be deployed and used in the marginalised contexts (Rosenberger, 2014). The researcher examines the validity of this claim by undertaking an analysis of the ability of the marginalised to engage directly with government using ICTs. This is because most marginalised communities are characterised by a vicious cycle of challenges coupled with illiteracy and poverty levels yet contemporary ICTs have the ability to facilitate new forms of e-government-enabled public sector service delivery (Chadwick, 2003). Such a vicious cycle of challenges, illiteracy and high

poverty levels are to be mitigated through participatory action and show relevance for adoption and use of such e-government applications.

In the marginalised community contexts, there could be empathetic engagements by agents who can empower such communities (Khumalo & Pather, 2018; Michie, Balaam, McCarthy, Osadchiy & Morrissey 2018). In this regard, Fleetwood (2005) and McLaughlin and Dietz (2008) reveal that there is no “unmediated access” to the world: and access is always mediated since an entity is said to be real if it has causal efficacy; has an effect on behaviour; and makes a difference. In marginalised contexts, Fleetwood’s modes of reality specifically refer to the “socially real” (practices, states of affairs, mediating agencies for marginalised communities) when confronted with “artefactually real” (entities such as computers and e-government technologies) (Fleetwood, 2005). According to Nieuwsma (2004), *agency* refers to the ability of social actors to act independently of larger structural forces to challenge the status quo. Such agencies consolidate efforts of the marginalized to build sustained social capital for change and transformation (Kirkby, Williams & Huq, 2018; Shakya, Cooke, Gupta, Bull & Greene, 2018).

Under Nieuwsma’s context of alternative design, agency refers to designers' ability to challenge the negative status quos and empower marginalised social groups (Nieuwsma, 2004; Haugh, & O’Carroll, 2019.). The conclusion, therefore, is that the role of agency in the participatory design process is crucial in triggering and developing empowering outcomes in the long term for powerless communities. It can be assumed that participatory design may result in empowering outcomes that may ultimately result in effective engagements of the marginalised with their governments. It has also been revealed that the other effects of e-government for citizens to maintain their status quo is the view that it brings about centralized control and decentralized action by governments. In pursuit of that effect, citizens think that their actions are remotely monitored by government authorities (Bretschneider, 2003; Fernandes & Patten, 2019). This relates to the perceived security and privacy as a reason for citizens to maintain their status quo regarding adoption and use of e-government (Sundberg, 2019; Michie, Balaam, McCarthy, Osadchiy & Morrissey, K., 2018; Bannister & Connolly, 2020). This study postulates that such beliefs and attitudes can be mitigated with adoption of participatory e-government design models.

To clearly understand such subjective factors like trust, several authors have argued for co-design framework within participatory design methodologies and design thinking principles (Bell & Nusir, 2017; Simonofski, Snoeck, Vanderose, Crompvoets & Habra, 2017). Paracha, Hall, Clawson, Mitsche and Jamil (2019) For effective user engagement and trust building in citizen e-government applications, co-design, design thinking and participatory design are commendable techniques (Simonofski, et al, 2017; Harden & Moore, 2019). However, the profiles of the designers could have an influence on design processes and design outcomes.

2.4.2 Influence of Citizen Users' and Co-Designers' Profiles on the Design Outcome

Users are widely acknowledged as a valuable source of creativity and knowledge in the development of new products, especially in the so-called “fuzzy front-end” of innovation processes (Buur & Matthews, 2008: 257). User profiles have been documented in literature as key determinants of design outcomes (Carroll, 2004; Stewart & Williams, 2005; Schaper & Pervan, 2007). Such user profiles influence the values, motivation and empowerment during the participatory design process (Asaro, 2000; Nabatchi, 2012; Jara, Parra & Skarmeta, 2014). Nieuwsma (2004) notes that demographics aid understanding the ‘governing mentalities’ – those widely shared values, expectations and assumptions of how the world operates being simultaneously the most important and the most difficult to identify. They are pervasive, subtle, distributed patterns of thought that underpin social activity and personal interpretations.

For instance, a study by Leong and Robertson (2016) reveals that ageing people’s values have an influence on the three social dimensions of self, friends and family, and community influence the expression of values. Their results, based on participatory design workshops, reveal how engaged ageing people are with others based on the social value dimensions. The most important values among this age group were purpose, belonging, competency, contribution and independence (Leong & Robertson, 2016: 34).

On the contrary, Frauenberger, Makhaeva and Spiel (2017) in their study *Blending Methods: Developing Participatory Design Sessions for Autistic Children*, reveal that their multi-methods of prototyping, roleplay and scenario building all yielded motivating outcomes among their

participants. In terms of participatory design tools for enriching design outcomes, the values and interests of children differ from those of the ageing citizen users (p. 40). Bratteteig and Wagner (2016) highlight key impediments to participatory design in their question: “What counts as a participatory design result?” They reveal the following: first, the universal agreement that participatory design gives participants a voice in the research process. The authors ideally note that a participatory design project outcome should be evaluated in a real use situation, when users have had a chance to integrate it into whatever they are doing based on the demographic profiles.

A notable user profile that could influence design outcomes is language. Galliers *et al.* (2012) highlight the challenges, solutions reached, and lessons learned whilst employing a participatory design approach. Design has its own language and jargon and yet from the marginalized communities’ context, language could be a key barrier, especially during element elicitation and construct generation. Effective communication, founded upon the production and understanding of oral and written language, is at the core of most participatory and user-centred approaches to technology design (Galliers *et al.*, 2012). The authors videoed the technique sessions of rating scales using thumbs-up or thumbs-down symbols or a range of smiley to glum faces to facilitate observed contributions. Empowerment issues – participants gaining confidence through more contribution and exhibition of happiness and feeling to recommend others to take part in such projects (due their opinion being taken into account); a feeling of going out to help others – were measured using rating scales for confidence 1-5 with 5 being most confident.

Kanstrup and Bertelsen's (2016) study among the vulnerable and marginalized young adults assessed their values by asking them to share prior social interaction with people similar to themselves through an activity they termed golden advice. Placing participants’ values at the forefront resulted in interesting and sustained motivation during the design process. So, participant values guided by prior co-design experience leads to variations in design outcomes.

Meanwhile, the gender of a user is another demographic profile that results in varied participatory design outcomes. For instance, in developing contexts with a number of marginalised citizens, the majority of these are rural women who form a growing portion of the

very poor, hence the notion of feminization of poverty (Lilja & Ashby, 2001). The authors note that by using participatory design, the level of participation can be expected to vary based on gender, depending on the innovation stages, which in turn results in varying technology adoption potential. Johnson *et al.* (2004) note that whereas participation is expected to improve the efficiency, equity and sustainability of applications, current practice lags behind best practices in key areas such as power sharing and participation levels from women and other marginalised groups.

Apart from age and gender, ethnicity and education level are other profiles that influence participatory design outcomes among the marginalised groups (Grudin & Pruitt, 2002). Sanders and Stappers (2008) argue that by assessing profiles like education levels of co-designers and other participatory design participants, the researcher's mindset is less likely to be a problem to overcome. However, during my study, I postulated that the demographic profiles of a participatory design team member were likely to influence the participatory design process as per views of various scholars (Carroll, 2004; Stewart & Williams, 2005; Schaper & Pervan, 2007).

The profiles of co-designers can also influence the design outcomes. Co-design teams can be assembled from a group of community-dwelling adult citizens and/or students in university research labs (Ellis & Kurniawan, 2000). These could be adults with some identity like women groups, youth groups, users identified by their livelihood means like small and medium enterprise citizens (Piller *et al.*, 2005; Brandt *et al.*, 2010; Malmborg *et al.*, 2016). On the other hand, Druin (2002; 2010) combines co-design with adults and children to enable them to share their ideas while minimizing the differences in their age and communication styles. In terms of co-design participants, Druin (2002) describes four possible roles of students during participatory design process:

- as a user (who can be observed or assessed);
- as a tester (who is also asked for comments);
- as an informant (who offers feedback and input); and
- as a design partner (considered as equal stakeholder in the design process).

However, while working with students as design partners, it is stressed that mature adult designers with highly formalized knowledge and experiential tacit knowledge should be gatekeepers to the design processes (Bovill & Bulley, 2011; Bovill, Bulley & Morss, 2011). Therefore, co-design team has a very central role to play in the e-government application design process. The co-design team's involvement evidences the initial phases of development of well thought e-democracy practices (Lee, Chang & Berry, 2011). Due to several iterations by the co-design team that involve empathy design, it results in citizen-centred designs if implemented within design thinking principles that transcend traditional pre-occupations of designers (Kimbell, 2011). To align the participatory design approach feasible for design of e-government for marginalized citizens, the following section reviews literature regarding the available well known information systems application development models, just in case a juxtaposition can be established.

2.4.3 Information Systems Application Development Models

Several information systems application models harness design thinking in attempts to bridge the design-reality gaps inherent of traditional design approaches while other do not (Karanasios & Slavova, 2019). Whereas some models are linear development processes, others are iterative (Kleinsmann, Valkenburg & Sluijs, 2017). However, this section elucidates some of the models to find any possible rationale for advancing a participatory design model for this study.

2.4.3.1 Linear Methods: Systems Development Life Cycle Using Waterfall Method

A well-documented application development method is the waterfall method, originated by Winston Royce (van Casteren, 2017), is one of the most utilized approaches to the Software Development Life Cycle model (SDLC) (Rani, 2017). Waterfall method is a stage based design that generally has the following serial stages: 1) Requirements analysis and definition 2) System and software design 3) Implementation and unit testing 4) Integration and system testing 5) Operation and maintenance (Hidayati, Listyorini, Listiawan, Kartini, Chusna, Sofyanti & Sallu, 2019). The waterfall method may be a linear process consisting of sequential development phases (system feasibility study, requirements analysis, project planning, system design, detailed design, coding, testing and integration, installation and maintenance) (Khalifa & Verner, 2000).

Each of the phases is documented in a report that must be formally validated before moving to the next phase.

This approach may not be a feasible design for marginalised communities like the poor, elderly, unemployed, youth, small and micro enterprise owners who are alienated from many government mainstream activities. Their design problems are close to “wicked problems” which are blurred in character and not easily defined (Rittel, 1972; Farrell & Hooker, 2013). Waterfall employs a linear process to problem solving as it is the pattern of thinking that everyone attempts to follow when faced with a problem that requires sequential solutions. It is normally enshrined in policy manuals, textbooks, internal standards for project management, and even the most advanced tools and methods being used and taught in our universities and the organization (Zweibelson, 2011). It is known as the *waterfall model* because it suggests the image of a waterfall as the project ‘flows’ down the steps towards completion as depicted (Conklin, 2001) in Figure 4 below:

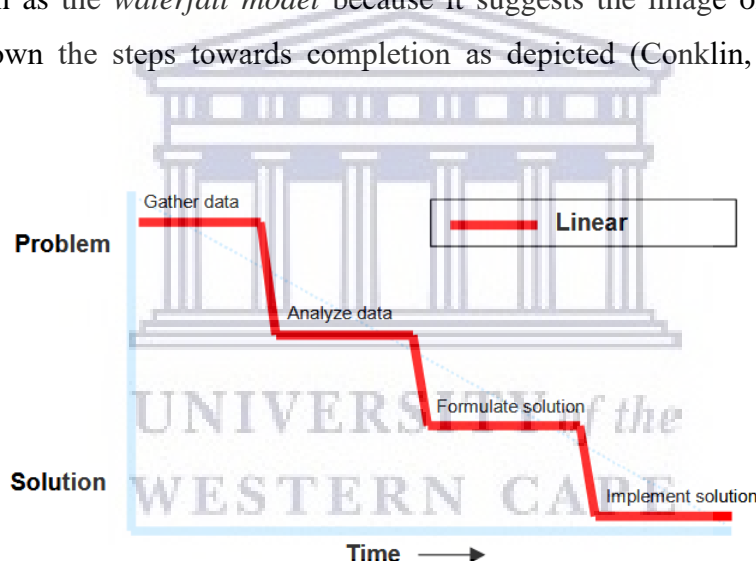


Figure 4: Traditional Wisdom for Solving Complex Problems: ‘Waterfall Model’

(Source: Conklin, 2001)

This approach has limitations that do not qualify it as a feasible participatory design approach for wicked problems among societies facing complex problems (Beltagui, Bell & Candi, 2019). Some of these limitations include: systems requirements are frozen before design begins and the users may not know or even have a clue to the problems being addressed beforehand; hardware technology is usually chosen early in the development process as part of the requirement specification (Rao, Naidu & Chakka, 2011). Given the speed with which hardware evolves, projects that take long periods may end up with specifications that are on the verge of

obsolescence, hence falling short of user centricity. The waterfall model does not allow for iterative enhancements as phases take a pre-configured structured linear approach (Khalifa & Verner, 2000). Other documented limitations include significant budget overruns, late or suspended deliveries and dissatisfied clients (Bassil, 2012).

Additionally, due to changing technological landscapes, customers find it difficult to define and align their needs well and this has resulted in new methods, now called agile methods, designed to define the changing requirements in software environments (Paetsch, Eberlein & Maurer, 2003; Rao, Naidu & Chakka, 2011). Moreover, wicked problems cannot be solved in a linear manner, as illustrated in Figure 5 below:

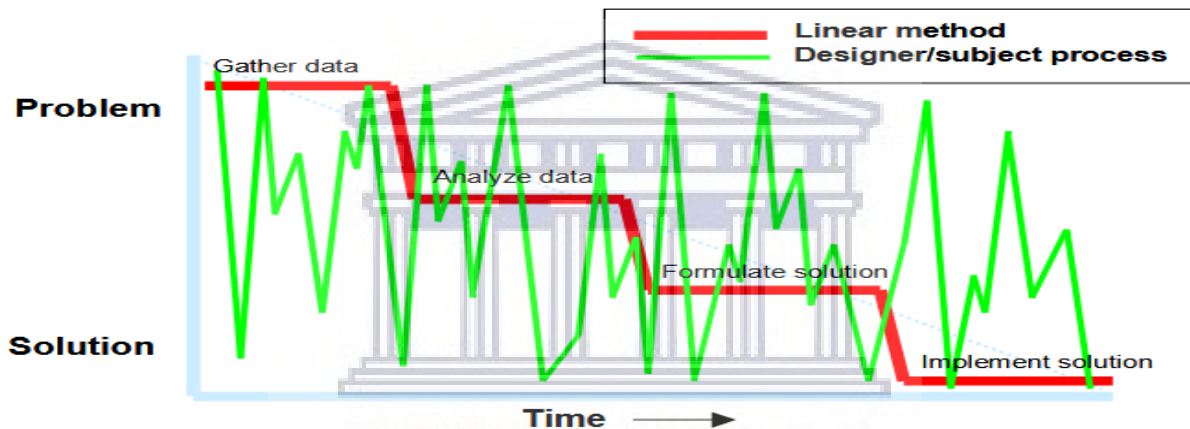


Figure 5: Pattern of Cognitive Activity of One Designer -- 'Jagged' Line

(Source: Conklin, 2001)

In both developed and developing contexts, the waterfall methods are a clear reason for e-Government systems to fail due to the well patterned approach of problem solving (Gil-Garcia, Henman & Avila-Maravilla, 2019). *Wicked problems*, as coined by Rittel and Webber, follow a natural pattern of problem-solving behaviour that reflects a deeper order in the cognitive process (Rittel & Webber, 1973; Ferlie, Pegan, Pluchinotta & Shaw, 2019). Such non-linearity of design led to other novel approaches termed 'agile' (Abrahamsson *et al.*, 2017, 11)

2.4.3.2 Systems Development using Agile Method

Agility denotes 'readiness for motion; nimbleness, activity or handiness in motion' (Abrahamsson *et al.*, 2017, 11). At its core, 'agility means to strip away as much of the heaviness, commonly associated with traditional software-development methodologies, as

possible to promote quick response to changing environments, changes in user requirements, accelerated project deadlines, and the like' (Erickson, Lyytinen & Siau, 2005, 89). Agile methods are often used when the process to achieving a specific project deliverable, such as a software program, is difficult or impossible to plan at the onset of the project (IAPM, Agile Project Management Guide 2.0).

Some of the methods that fall under the agile category are: extreme programming (XP) (Beck, 1999a; Beck, 1999b), SCRUM (Schwaber & Sutherland, 2011), Kanban, (IAPM, Agile Project Management Guide 2.0), Joint Application Development (JAD) (Carmel, Whitaker and George, 1993, Crystal methodologies (Cockburn 2000), adaptive software development (Highsmith 2000), feature-driven development (FDD) (Palmer & Felsing 2002) and dynamic systems development (Beck *et al.*, 2001; Fowler & Highsmith, 2001). A major limitation of these agile methods revealed by Conboy (2004) is that there is no consensus as to what constitutes an agile method and that they lack grounding in theory. It is further urged that designers adopting agile methods examine its theoretical roots since no academic articles on the subject can be found anchored by theoretical lenses (Dijksterhuis & Silviu, 2016).

2.4.3.3 Systems Development Using Spiral Methodology

To address the challenges of linearity during application development, Barry Boehm (1985) introduced the spiral methodology under which each waterfall phase is concluded with a risk assessment and prototyping activity as illustrated in Figure 6 below:

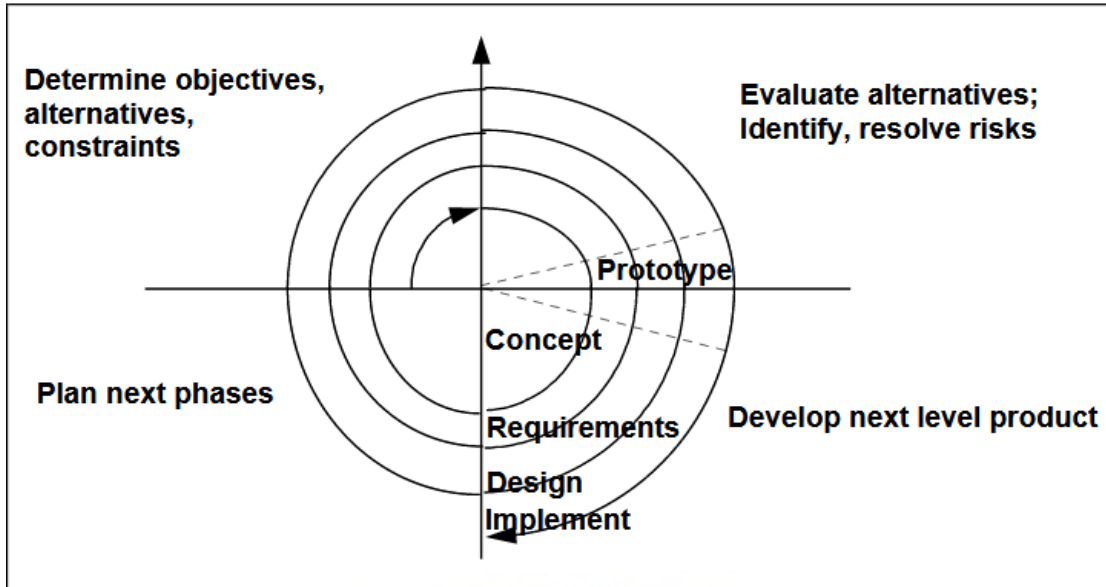


Figure 6: Spiral Methodology

(Source: Boehm, 1985)

The spiral methodology “peels the onion,” progressing through “layers” of the development process (Schwaber, 1997: 122). A prototype lets users determine if the project is on track, should be sent back to prior phases, or should be ended. However, the phases and phase processes are still linear. Requirements work is still performed in the requirements phase, design work in the design phase, and so forth, with each of the phases consisting of linear, explicitly defined processes (Boehm, 1985; Schwaber, 1997). This implies that the spiral methodology of design suffers the same limitation inherent in the waterfall and agile methods. Other scholars and designers have argued for an iterative method to design.

2.4.3.4 Systems Development Using Iterative Method

The iterative methodology (Figure 7 below) improves on the spiral methodology (Nerur, Mahapatra & Mangalaraj, 2005).

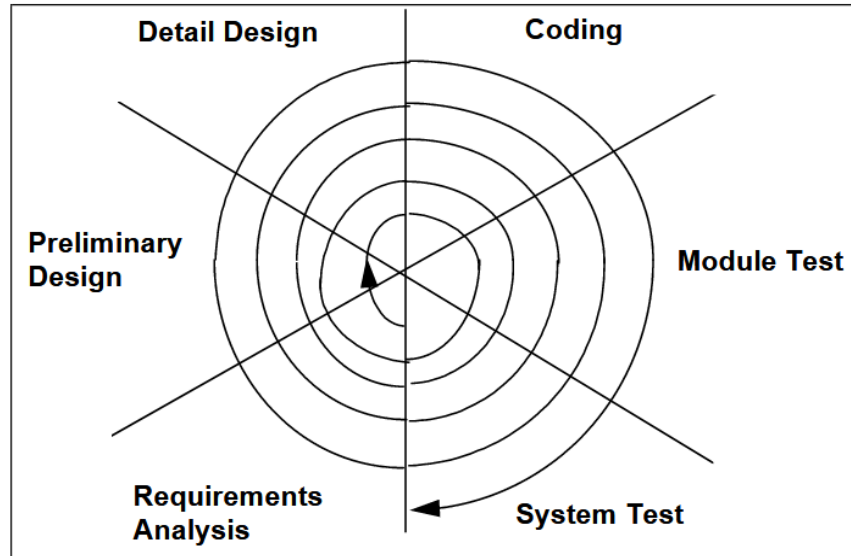


Figure 7: Iterative Design Methodology

(Source: Schwaber, 1997)

Within this methodology, each iteration consists of standard waterfall sub-phases addressing one set of functionalities. This then implies that the project deliverable is partitioned into prioritized sub-systems, each with its own interfaces. It is observed that using this approach, one can test the feasibility of a sub-system and technology in the initial iterations (Schwaber, 1997). This approach improves cost control, ensures delivery of systems (albeit sub-systems), and improves overall flexibility. However, the iterative approach still expects that the underlying development processes are defined and linear (Kelley, 1984; Boehm, 1988; Schwaber, 1997; Nerur, Mahapatra & Mangalaraj, 2005). Moreover, from reviewed literature, the methodology takes a classical traditional designer led view and negates the role of the users in the development process.

2.4.4 From Traditional Approaches to Non-Linear Methods

From the traditional approaches (waterfall methods), there are a number of non-linear patterns of design activities that expert designers use, giving fresh insights into what is happening when working on complex and novel problems. Conklin (2001) notes that such methods reveal the designer's feeling of "wandering all over". This is not a mark of stupidity or lack of training, but the mark of an intelligent and creative learning process. "Wandering all over" calls for the

designers' unique conceptualization of designs for marginalised people's solutions especially in e-government interventions. They have been traditionally termed as agile methods of design. However, the non-linear methods (agile and SCRUM) have assumed that the systems development processes are a loose set of activities that can roughly be described as an overall progression and lack theoretical grounding (Lee, 2006). From the foregoing debates, the following limitations can be summarized, hence the need for a design model that is anchored both in theory and practice:

- a) There is a lack of theoretical grounding in these methods.
- b) The methods assume that the solutions are developed in a linear style, which may not be the case.
- c) There is too much of managerial focus as a way of delivering value to project sponsors and very limited focus on the end user.
- d) Agile methods are a family of development techniques designed to deliver products on time, on budget and with high quality and customer satisfaction. Whereas satisfaction may be in form of application use to enhance performance in an organization setting, a typical marginalised citizen of a government service may have varying satisfiers from the performance-based satisfiers. Moreover, the evaluation criteria of "on time, on budget, with high quality and customer satisfaction" is relative and can be determined by the unit of analysis.
- e) The foregoing design methods have been criticized to be one sided and lack of alignment of design processes and human-centered design orientedness.

From such limitations, there is need to address the missing link in agile methods for design of applications for marginalised communities. Agile methodologies seem to be the best approaches for design of solutions for complex problems with well-documented assumptions and principles such as the need for individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, responding to change over following a plan (Skowronski, 2004). Moreover, scientists have called for special attention to the design of solutions for wicked problems even with available agile related methods, arguing that such problems lack definitive formulations and therefore linear analytic approaches are unlikely to resolve them (Liedtka, 2015). In addition, it is revealed that one of the

major shortcomings of many software development processes, agile inclusive, is their marginalisation of usability issues. Agile methods, which are incremental and iterative in nature, do not support any kind of comprehensive overview of the architecture, an important part of making consistent and usable interfaces (Lee, 2006). Usability engineering is concerned with developing interfaces that people can use efficiently and effectively. It deals with issues such as system learnability, efficiency, memorability, errors and user satisfaction among others (Nielsen, 1994a).

From the above reviews, this study aims to render support to other numerous usability-engineering methodologists that share the view that usability must be at the forefront of system design, focusing on end users (Carroll, 1997; Norman, 2002; Cooper, Reimann & Cronin, 2007; Rosson & Carroll, 2009). Some scholars doubt the relevance of questions posed by system. Gomez and Pather (2012: 1-14) in their study, *ICT evaluation: are we asking the right questions?*, state that focus needs to be on motivation of the intangible benefits of ICT on development such as empowerment, self-esteem and social cohesion as more important from a developmental perspective. Similar approaches have been advanced by scholars like Rosson and Carroll's Scenario-Based Design, a design process in which scenarios and narratives describing a particular task are used in conjunction with design knowledge components called claims, which encapsulate the positive and negative effects of specific design features as a basis for creating interactive systems (Rosson & Carroll, 2009).

2.4.5 Link between Design Thinking and Information Systems Design

Quite often, most information systems design work has been likened to design thinking principles recommended especially for design of wicked problems. When design thinking is applied within the information systems discipline, its innovation brings about countless examples for unexpected solutions, changes in working cultures and improvements in team performance (Plattner, Meinel & Leifer, eds., 2015). Plattner, Meinel and Weinberg (2009) reveal that Hasso-Plattner-Institute of Design at Stanford University in California taught Design Thinking to engineering students to become innovators of information systems design models. Such models should be innovative and integrate human, business, and technological factors in problem forming, solving and design (Plattner, Meinel & Weinberg, 2009; Johansson-Sköldberg, Woodilla & Çetinkaya, 2013). The human-centric models should integrate expertise from design,

social sciences, engineering and business. According to Plattner, Meinel and Weinberg (2009), the following themes are critical for design thinking research: design is social in nature, there is need to preserve ambiguity and all design is re-design. This then implies that from a socio-technical view, design work is an iterative process. Meinel and Leifer (2011) offer a pictorial view of design thinking, an illustration that allows it to develop unique models that can fit varied contexts.

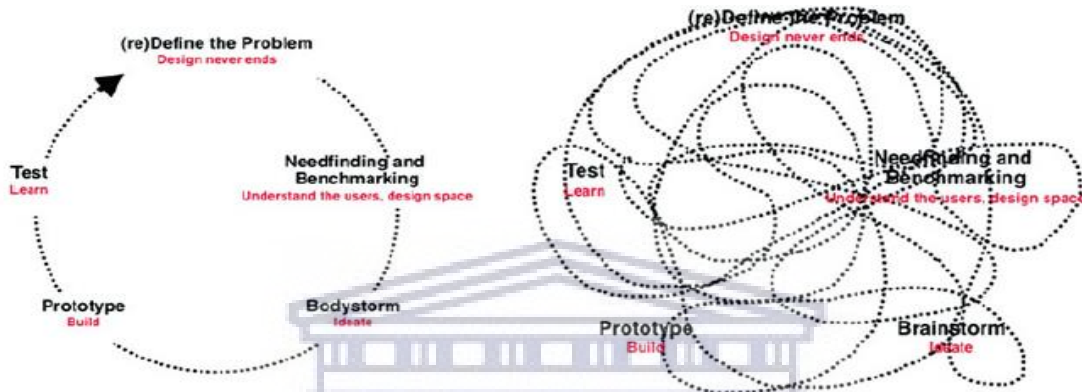


Figure 8: Design Thinking Fits Varied Contexts

(Source: Meinel & Leifer, 2011)

Meinel and Leifer (2011) observe that design thinking is commonly visualised as an iterative series of stages as may be determined by the design team based on the nature of the problem being addressed. To the left is the standard form (linear design). To the right is something closer to reality (Meinel & Leifer, 2011). Whilst harnessing design thinking, several information systems applications development models have been advanced and the next step is to find any juxtaposition for available models that can align with participatory design process for the solving of wicked problems for marginalised communities (Peter, 2015; Kidd *et al.*, 2018). Table 7 summarizes some of the design thinking models that have commonly been used in practice and academia:

Table 7: Available models of design thinking

Stage	IDEO	Continuum	Stanford Design School	British Council Double Diamond	Rotman Business School	Darden Business Schools
Stage I data gathering about user needs	Discovery and interpretation	Discover deep insights	Empathise and define	Discover	Empathy	What is?
Stage II idea generation	Ideation	Create	Ideation	Define and Develop	Ideation	What if?
Stage III testing	Experimentation and evolution	Make it real: prototype, test and deploy	Prototype and test	Deliver	Prototyping and experimentation	What wows? What works?

(Source: Adapted and modified from Liedtka, 2015)

Based on the aforementioned design schools of thought, the processes can be summarized as inspiration (divergence) where a design challenge is identified; ideation (convergence) where several opportunities and concepts for design are identified with divergences and convergences and finally implementation resulting into convergence. Due to divergences and convergences, the design process becomes iterative. The British Council Design School of Thought (2005) devised their model in form of Double Diamond, with the diamonds used to reveal points of divergences and convergences between the designers' conceptual models and citizens' mental models. When in divergent mode, quite a number of beliefs, attitudes and assumptions are revealed during the design process. Furthermore, scoping or problem definition leads to mental convergences between citizens and designers. This is followed by development with low fidelity prototypes and presentation of actual artefact to yield further insights into the design.

From the available literature, design thinking utilizes creative methods to address the architectural and usability issues through in-depth requirements and task analysis processes at the beginning of the design process. Brown and Wyatt (2010: 32) observe, "Design thinkers look for work-arounds and improvise solutions and find ways to incorporate those into the offerings they create. They consider the edges, the places where 'extreme' people live differently, think differently and consume differently". Design thinkers use non-conventional approaches like

theatre, performing arts, expressive user persona, and empathetic design (Newell *et al.*, 2006). From the review of available design models and design thinking schools, key underlying themes that differentiate design-thinking problems from linear analytic methods are summarized in Table 8 below:

Table 8: Design Thinking and Linear Analytic Models to Design Summarized

Critical focus...	Design thinking is appropriate is....	Linear analytic methods may be better if...
Problem is human centred?	Deep understanding of the actual people (users) involved.	There are few human beings involved in problem or solution.
How clearly do we understand the problem itself?	We need to explore and get agreement, resolve inconsistencies, do away with divergences and reach convergences.	We understand the problem clearly and are sure we are solving the right one.
What is the level of uncertainty?	There are many unknowns (large and small), and past data is unlikely to help us.	The past is good predictor of the future.
What data is already available?	There is very little relevant data to analyse.	There are several clear sources of data.

It can be further summarized that design thinking, an approach to problem finding and problem solving, calls for a high degree of empathy and understanding of end users, and an iterative process of developing new ideas, challenging assumptions, and redefining problems, with the goal of identifying alternative solutions that might not be immediately apparent. From the foregoing non-linear models, the next section is advanced based on British Council Double Diamond model (2005) of Discover, Define, Develop and Deliver; as can be used in an iterative way. From the participatory design paradigm, this section reviews literature to examine how co-design can be incorporated hence Co-Discovery, Co-Definition, Co-Development and Co-Delivery (Bell & Nusir, 2017).

2.4.6 The Double Diamond

The ‘Double Diamond’ is a useful concept that has been used for decades in value engineering, design (British Design Council, 2005), culture change, and service. Within each diamond various

alternatives are generated, considered, and the appropriate solution selected (Bicheno & Holweg, 2016). The model is presented in the Figure 9 below:

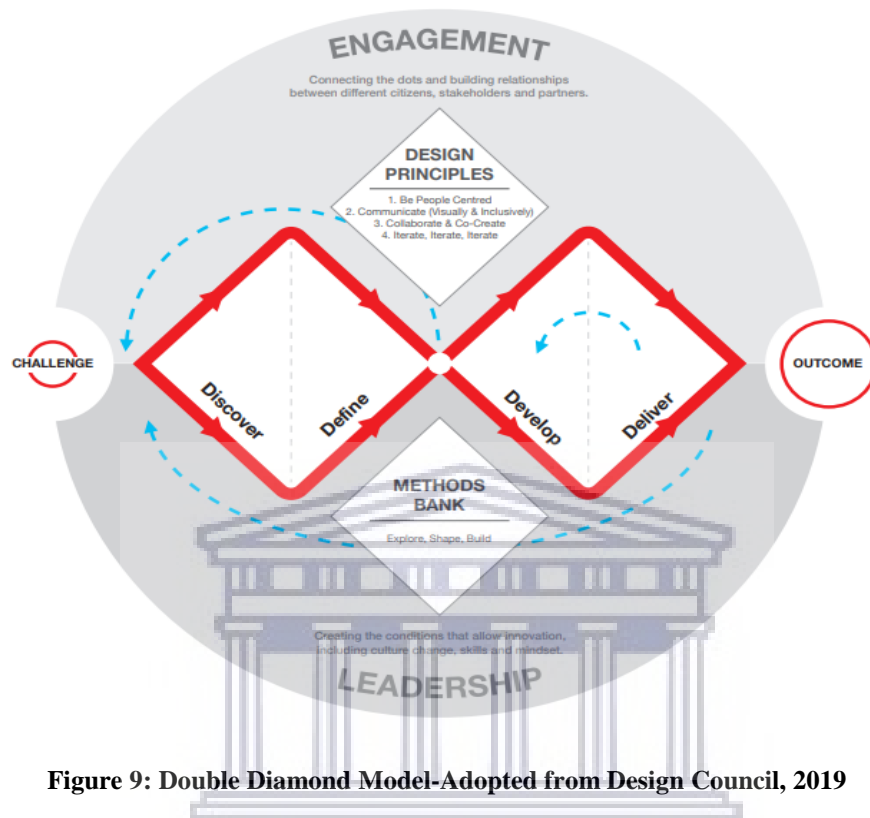


Figure 9: Double Diamond Model-Adopted from Design Council, 2019

From the figure, double diamond model is a non-linear process with the two diamonds representing a process of exploring an issue more deeply and widely (divergent thinking) and then taking a focused action (convergent thinking). For Discover in the first Diamond helps participants to understand, rather than simply assume what the problem is. While speaking to and with the people affected by the problems and/or challenges, a number of ideas will be generated; an ideation process. In the Define phase, the insights gathered from the Discovery phase helps the design team to define or scope the challenge/problem/ideas in a different way. Within the Develop phase, different answers and solutions are generated to the clearly defined problem seeking inspiration from elsewhere and co-designing with a range of different people as deemed by the design team. Finally, the Deliver phase is a testing phase of the different solutions at small scale, dropping those that will not work and improving the ones that will. All these [phases] are undertaken within the design thinking principles that include: putting people first, communicating visually and inclusively, collaborating and co-creating among and within the design teams and undertaking several iterations to mitigate errors, avoid risk and building

confidence in the solutions. Within are methods that will be elucidated in the methods chapter that include but not limited to: exploration (challenges, needs, status-quo, opportunities); shape (prototypes, insights, voices, artefacts); build (plans, ideas and expertise). Meanwhile, there is need for leadership and engagement among and with people delivering the ideas and receiving them, together with other partners who may have the ideas.

In developing nations, this model has been utilized by several researchers. For instance, it has been used for service innovation design (Du Preez, 2016). Malete (2016) used it for exploring Transnational education and internationalization of education as tools for higher education transformation and economic development in emerging economies. Dhewanto, et al (2015) used it to investigate the innovation cluster of ICT start-up companies in developing countries. Whereas it has been applicable in its original form, this section reviews literature related to inserting a pre-fix 'co' to the rest of the model phases to align it close to a participatory design context. However, the researcher provides a brief account of participatory design.

2.5 Problem Discovery, Definition and Scoping within Participatory Design

Context

Whereas most literature adapting British Double diamond model use Discovery (Cahya, Handayani & Wibawa, 2018), the author adapts and adopts the notion of '*Co-problem discovery*' to imply an ideation process when the design team deliberates through a number of research and design activities to understand the actual designable problem from a number of ideas generated from users or citizens. i.e users/citizens generate ideas which to them are problems while design team in-house draws insights from these ideas into real designable problems (Clune & Lockrey, 2014). Ideation a Design Thinking task aimed at generating a large quantity of ideas that the design team can then filter and cut down into the best, most practical or most innovative ones in order to inspire new and better design solutions and products (Nielsen, 2011).

During this phase, two key concepts of participatory design and Co-design are employed. It is acknowledged that co-design is an example of an approach established in PD approach (Sanders and Steppers, 2008). Contradictly Salamao, Sabiescu and Cantoni (2013) confuse that that co-design is a step beyond PD approaches where artefacts are created with a shared vision, social learning and mutual understanding between the designer and the participants. From yet a

different perspective, Ssozi-Mugarura, Blake and Rivett (2016: p.91) use co-design as the application of action research in a design setting with technology probes to elicit requirements, collaborate with communities as an artefact is developed and evaluated. In this study, participatory design is used in a wider perspective than co-design. Co-design is when the application development is undertaken among the design team members, taking and switching roles of designers and users (Paracha, et al 2019). Participatory design is when end users are integrated into application development (prototyping and artefact design simulations) (Simonofski, et al, 2017). However, both participatory design and co-design for e-government aim at improving design outcomes for improving e-government services as a major public value expectation from citizens (Twizeyimana & Andersson, 2019).

Björgvinsson, Ehn and Hillgren (2010) distinguish between design in a public sphere and design for organizations and companies. They observe that a major challenge has to do with what is to be designed – whether we design an object or service. This then implies that discovering the problem to be designed and scoping it down from alternatives of problems is fundamental. In that context, Ehn (1988) points out that in order to cope with local and public design controversies, there is need for collective agreements and legislative conflicts through developing negotiation models. Under e-government application designs, such legislative conflicts could come from government pronouncements to the public (top-down) or from the public (bottom-up). This study advocates for the latter. However, during problem discovery and scoping, the public “thing” to be designed need not conflict with government legislation and pronouncements by the government to the citizens. This is because, as Cordella and Iannacci (2010) observe, e-government projects are intrinsically embedded in combinations of political reforms and organizational changes designed to enact, support and drive a profound transformation in the organization of the public sector. It has further been revealed that research in the field of e-government has so far prioritized the study of the effects of information and communications technology as a shortcut to increase public sector efficiency and to improve administration and management capabilities (Saxena, 2005; Anthopoulos, Siozos & Tsoukalas, 2007; Cordella, 2007; Cordella & Bonina, 2012).

The impetus for effective co-problem discovery and scoping in the design of public applications is an examination of broader impacts that e-government policies and legislations can have on

public sector organization and the services it delivers (Anthopoulos *et al.*, 2007; Cordella & Iannacci, 2010). Furthermore, the relations between ICT policies and public sector reform is important to examine in order to understand the factors that steer and shape e-government projects (Ciborra & Navarra, 2005; Bekkers & Homburg, 2007; Cordella & Bonina, 2012). Failure to undertake feasible e-government design for poor communities has been linked to the lack of in-depth analysis of the political nature of the e-government development processes, and a deeper recognition of complex political and institutional environments (Yildiz, 2007: 646). Similarly, Cordella and Iannacci (2010) emphasize that most technology (e-government) enactment frameworks do not account for e-government policy drivers that influence the choice and design of public sector ICTs. It is thus important to identify requirements from a bottom-top approach from the typical citizens while also examining the e-government policy drivers at the policy-making level. Based on the foregoing, it can be concluded that there lies design-reality gaps between the typical citizens' requirements and the policy drivers of e-government.

A framework developed by Fountain (2001) and later extended by Cordella and Iannacci (2010) accounts for ICT and the impact it has on the landscape within which rules, policies and structure influence perception and action. However, this is at the designer's level, with no user involvement during problem discovery and scoping. Cordella and Iannacci (2010), though, observe that there is need to analyse the complexities associated with the implementation of technological solutions in public sector organizations through examining e-government policy perspectives, ICTs applications to be designed and necessary public sector reforms. In this study, such an analysis of e-government policy perspectives alongside public requirements for design of ICTs is what is termed as *citizen-centric design*. It has also been revealed that e-government initiatives are continuing to increase in complexity and require both a deep knowledge of the project itself and the policy context in which it is embedded (Helbig, Gil-García & Ferro, 2009).

During the problem discovery and scoping for design of citizen-centric e-government applications, Meijer, Curtin and Hillebrandt (2012) argue that there is need to connect the vision (e-government policy perspective) to the voice (typical user citizen). They further advise that e-government is too important to be left to the 'techies' and that scientists and practitioners with diverse backgrounds in law, economics, political science and the public should also be involved

in building sound connections between vision and voice that facilitate active citizenship through participation. Citizens need government transparency and participation in order to voice their opinions while at the same time posing a crucial question for vision of what is being rendered visible (Bennett, 2008). This therefore implies that citizens' voices should meet e-government vision if citizen-centric e-government applications are to be designed.

One way to get such citizen voices to align with the government vision, during problem discovery and scoping, has been through pilot studies (Bhatnagar, 2004; Anthopoulos, Siozos & Tsoukalas, 2007; Rose & Grant, 2010; Lofstedt, 2012). Through pilot projects that are operational for a given period, policymakers have a useful inventory of service data, which they can evaluate with statistical analysis in order to realize most requested services, decode and simplify complex services, and allocate distributed knowledge in the public sector (Anthopoulos *et al.*, 2007; Siozos & Tsoukalas, 2007: 370). Similarly, Lofstedt (2012) has emphasized that towards e-democracy, pilot projects help designers to better identify both types of citizen participation exercises and the appropriate technology to support them. Leong and Robertson (2016) have also used pilot workshops in order to engage ageing people in design.

From such debates, it can be concluded that pilot projects are key strategies for problem discovery and scoping during the participatory design process. From the foregoing debates, it can be concluded that co-problem discovery and scoping contributes to bridging the design-reality gaps through aligning citizen viewpoint with that of government commitments and their respective agents/designers. Overall, Weber, Harbach and Smith (2015) exploration suggests that PD can provide a suitable, versatile, and simple set of methods that support the creation of design ideas for user interfaces. Users are empowered to critically appraise and adapt the designed systems, encounter challenges that they come into contact with in their everyday life on their own. Throughout the design thinking based models, the word *empathy* stands out as a behavioural simulation method and it has been termed as *empathetic design*. This then implies that key participatory design principle is '*empathy*' hence this paper's notion of '*empathetic participatory design*.' This is coupled with the evaluation of the design outcome by the design team for better familiarity prior to its delivery to the real intended users.

2.6 Empathetic Participatory Design

Diversity of users (citizens) is a challenge when marginalised people are involved. Obtaining requirements and evaluation data from marginalised groups is not straightforward. Monitoring and interacting with them in their home environment, rather than the workplace, can provide additional organizational challenges (Newell *et al.*, 2011). These include diverse user characteristics affecting design outcomes, different user groups providing conflicting requirements and ideas for a product and conflict among system usability issues.

This implies that prior to embarking on community participatory design processes (design with communities), design teams need to engage in a detailed preparatory exercise by examining the potential user demographics, context and user situation through a process of empathetic participatory design (Kyakulumbye, Pather and Jantjies, 2018) or behavioural simulation (Morecroft, 1985; Staunstrup and Wolf, 2013). In this respect, the co-design team members bring forth their tacit and explicit design knowledge to enrich the design process and outcome before and during the typical user experiencing design phase (Sanders, 2003; Wright & McCarthy, 2008; Kouprie & Visser, 2009). The adaptation of this approach of ICT application design which has been termed as '*empathetic participatory design*' (Kyakulumbye *et al.*, 2019) is drawn from several studies, including Lindsay *et al.* (2012), Kouprie and Visser (2009), Hawley (2007) and Sanders (2003).

The term 'empathetic user experience design' is rooted in all of the latter studies. In this study context, the term 'empathetic' highlights the importance of the design team (co-design team) to better understand a prospective user audience by living through common experiences or facing the same challenges related to usability as users may face. It is participatory in nature where the co-design team members walk through and rehearse the design methods prior to real design in a community setting. Empathetic participatory design enables the design team to make appropriate choices for users based on several iterative scenarios aimed at understanding the varied citizen contexts (Kouprie and Visser, 2009; Petersen, 2017). It has its roots in design processes which evolved when it was found that understanding user responses through questionnaires was not enough to develop successful artefacts (Sanders, 2003).

Empathetic participatory design acknowledges accountability of design to the lives of those who will be affected by the design process and its outcomes (Norman, 1988; Norman, 1999; Stolterman, 2008). The design team undertaking empathetic participatory design goes through reflective experiences, resulting into a hybridity of knowledge. Such knowledge hybridity (tacit and explicit reciprocation) leads to new diverse knowledges into design insights and plans for action (Muller and Druin, 2010).

Both tacit and explicit knowledge types have been debated in the extant literature. Fundamentally, Cook and Brown (1999: 385) believe that “tacit knowledge cannot be turned into explicit knowledge, nor can explicit knowledge be turned into tacit”. However, during empathetic participatory design, the two forms of knowledge may be reciprocal during the process of design. Such an assertion lends support to Wynn and Williams (2012) who argue that the generation of new knowledge is the result of “... *our interaction with the world,*” because the world and entities that constitute reality exist ‘out there’ independent of our human knowledge. Knowledge is not only a belief of knowing and thinking but rather an ability to transform it into real action (Kyakulumbye, *et al.*, 2019). Other researchers have similarly argued that tacit and explicit forms of knowledge are inextricably linked and that knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge using modes of ‘knowledge conversion’ (Nonaka and Takeuchi, 1995) during the empathetic participatory design process.

The proponents of empathetic participatory design argue that due to several true participatory design challenges, it is impossible to design for and with all or to undertake universal design that encompasses all citizens in a marginalised setting (Lindsay *et al.*, 2012; Kyakulumbye, *et al.*, 2019). The use of the term “inclusive” as opposed to “universal” reflects the view that inclusivity is a more achievable and appropriate goal than universal design or “design for and with all” (Wright & McCarthy, 2008). In addition, to other authors “sensitive” replaces “centred” to indicate that it is rarely possible to design a product that is truly accessible to all potential users (Newell *et al.*, 2011). Bergold and Thomas (2012) note that such universal design dilemmas can be defined by representatives of the dominant social group – in this case scientists – who specify the necessary knowledge and ability against the background of their familiar worldview and their methodological requirements. The design team enters the field as “foreigners”; as time goes by,

through empathetic participatory design process, they assume the role of "mobiliser," "service provider," "provider of information," and "ally" (Malmborg, *et al.*, 2016). Eventually they become "patrons" and, in the best case, they finally become "mentors" (Schön, 2017). Through empathising, the design team can be able to undertake artefact evaluation prior to simulating and testing the application among potential users (Krauss, 2005).

2.7 Artefact Usability Requirements for Marginalised People

Design scholars from diverse fields have attempted to assist marginalised social groups by redirecting design thinking toward their needs (Nieusma, 2004). As a response to failures of technology transfer approaches, "appropriate technologists" argued that context suitability should be central to identifying technologies relevant to poor people of the third world and other marginalised social groups (Hussain, Sanders & Steinert, 2012). Universal design theorists argue that inclusion applies not only to access, but also to psychosocial aspects of people's interactions with the built world (Ozer & Schotland, 2011). According to Nieusma (2004) and Newell *et al.* (2006), the design requirement starts from the design team point of view to account for: diversity and disagreement during participatory design, accepting and coping with uncertainty, theorising agency-structure tensions and accepting the importance of governing mentalities.

In terms of artefact usability requirement, governing mentalities of users may have most devastating outcomes if not well addressed or embedded in the artefact. Designers are warned to understand that the forces shaping dominant design norms run deep. The governing mentalities that shape what is "good," "right," and "true" are the most difficult to identify and the most important to challenge, yet they may determine the sustainability and use of designed systems. These governing mentalities can be shaped by short-term working memory and long-term working memory, and this has been referred to as situation awareness (Endsley, 1995). As technology has evolved, complex and dynamic systems have been created that tax the abilities of human beings to act as effective, timely decision makers when using such systems (Endsley, 1995). Simon notes, "Though the world we live in today is much more a man-made or artificial world than it is a natural world, it is real and man in it is real" (Simon, 1996: 14, 25). Simon

further warns that there is need for considering human cognition as scientists advance their agenda for designing and understanding intelligent systems.

2.8 Summary of Literature Review

Context is critical when undertaking or planning any information system development intervention. Such a context assessment will help tailor the intervention and reveal any barriers. The approaches to understanding such a complex context therefore require multiple perspectives including empathetic art strategy deemed critical under this study. During intervention deployment, there are various triggers (generative causes) resulting in various mechanisms (observed and unobserved). This study argues that whereas social interaction is vital, the unobserved may be revealed through creative empathetic approaches. They are these generative causes and mechanisms that often result in use or underuse or non-use of interventions. In this study, the researcher not only asks why the intervention works or does not work, the designers/researchers further ask, for whom and under what circumstances does it work or not. There is need to review ICT adoption theories and other peripheral related theories that may help understand system usability issues. Available information systems design models are linear in form, progressing from one step to another. However, the available design methods that harness design thinking have been criticized for a lack of a theoretical grounding. This leads to study results criticized for theory-practice inconsistencies. Adopting design science research and finding a theoretical underpinning could add value to the information systems body of knowledge while enriching the e-government practice world.

CHAPTER THREE

THEORETICAL FRAMING OF THE STUDY

“Constructs in theoretical statements need to refer to entities in the real world, without necessarily being hooked on to particular research paradigms,” (Gregor, 2006).

3.1 Introduction

“The logic of an enquiry flows from broad philosophical assumptions to specific questions and then to methods used to answer the questions,” Swanson and Holton (2005: 322). Philosophical assumptions guide the enquirer’s perspective of the world into which the research is conducted (ontology), the knowledge being known (epistemology), the values brought to enquiry (axiology), the language used (rhetorical approach) and the process of investigation (methodology) (Creswell, 2013: 54). From the reviewed literature, philosophical orientations within information systems design science research do not overtly surface during the research process, and yet they seem to determine our decisions and actions knowingly or even unknowingly (Mingers, 2000). Such observation has been particularly emphasized by Carlsson (2006: 192) who reveals that under design science research, guiding research frameworks and approaches have very little discussions and clarifications regarding underpinning philosophies, but most seem to anecdotally be based on positivism, traditional realism, or pragmatism.

The debate of the philosophical orientations of former design science studies that have already been undertaken is not the focus of this study but we need to generate a guiding worldview for this study that is realistic enough to understand the complex design activity. Notably, failure to situate design science research within a philosophical lens could be attributed to its complexity, fragility, messiness, and eventual solidity of the design and doing so in a way that will be valuable to others (Barab and Squire, 2004: 4). In such a complex context, philosophical orientations that allude to a stratified ontology can help to identify and understand the sub-groups within the population, so that the designer can work effectively within each subgroup (Easterbrook, Singer, Storey and Damian, 2008: 288). The next section offers the evolution framework of philosophical orientations from which several other researchers make a choice to guide their research enquiries. Philosophical origins have a long history and such evolution is summarized in the appendix. This is because discussing the development in the history of

thought potentially informs contemporary discussions in a given discipline (Argyres, De Massis, Foss, Frattini, Jones & Silverman, 2020).



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The current study is a design science research-based study and its philosophical situatedness needs to be explained by contemporary philosophical debates and views from which the rationale for a given study can be informed:

Table 9: Contemporary Research Paradigms

Research Paradigms					
Element	Positivism (Naïve realism)	Post positivism (Critical Realism)	Interpretivism (Constructivism)	Pragmatism	Critical Theory
Origin and Scholasticism (a mind towards a traditional doctrine) and logos (logic behind an argument)	Aristotle; defended by Thomas Aquinas; followed by John Lock, George Berkeley; Hillary Putnam; John MCDowell; Kant; Comte (Bernecker, 2008)	Sir Carl Popper followed by Thomas Khun (Popper, 1959) and later Critical Realism by Roy Bhaskar (Sayer, 1997).	Max Webber, Kant, Jurgen Habermas (Viskovatoff, 2000)	Charles Sanders Peirce, William James and John Dewey	Frankfurt school of social research
Ontology (the position on the nature of reality)	External, objective and independent of social actors. Reality is real and apprehensible as a perception generated by neural processes in our brain	Exists independently of human thoughts and beliefs or knowledge of their existence but is interpreted through social conditioning. Reality is “real” but only imperfectly and probabilistically apprehensible and so triangulation from many sources is required to try to know it	Socially constructed, subjective and may change. Multiple local and specific constructed realities.	External, multiple views chosen to best achieve an answer to the research question	Virtual reality shaped by social, economic, political, ethnic, cultural and gender values crystallized over time
Epistemology: the view of what constitutes acceptable knowledge	Only observable phenomena can provide credible data, facts. Focus is on causality and law like generalizations, reducing phenomena to simplest elements. Findings are true –	Human knowledge is based not on priori assessment from an objective individual but rather upon human conjectures. Only observable phenomena can provide credible data, facts and focuses on explaining within a context or contexts. Findings probably true – researcher is value-aware and needs to triangulate any perceptions he or she is collecting. The	Subjective meaning and social phenomena. Focus on the details of the situation, the realities behind these details, subjective meanings and motivating actions. Created findings where researcher does not need priori theories to	Observable phenomena and/or subjective meaning can provide acceptable knowledge depending on	Value-mediated findings

	researcher is objective by viewing reality through a “one-way mirror”	researcher should encourage and support the participants to critically examine their own understanding. It should be a common effort, which also includes the researchers’ own concepts and theoretical models. Argued for falsifiability not verifiability	inform an investigation	the research question	
Axiology: the role of values in research and researcher’s stance	Value-free and etic; the researcher is independent of data and maintains an objective stance	Value-laden and etic; critical ethos; discusses how a balance between different interests can be achieved. The researcher is biased by worldviews, cultural experiences, prior knowledge, and upbringing. There is argument that theories, background, knowledge and the values of the researcher can influence what is observed	Value bond and emic. Researcher cannot be separated from what is researched and therefore will remain subjective	Value bond and etic-emic	Value laden
Research methodology: the model behind the research process	Quantitative and most concerned with testing of theories. Methods include surveys, experiments and verification of hypotheses	Quantitative or qualitative or multi-methods; Participatory action research/interactive research. Multiple diverse case contexts across cases to have a multiple view of phenomena for global decision-making	Qualitative with in-depth interviews and observations	Quantitative and qualitative (mixed methods)	Participant observation and action research

(Sources: Developed from: Popper, 1959; Sobh & Perry, 2006; Svensson, Ellström & Brulin, 2007; Bernecker, 2008; Suri, 2011; Wahyuni, 2012)

From the table, the two main philosophical dimensions to distinguish existing research paradigms are ontology and epistemology (Remenyi, Pather & Klopper, 2011). From several philosophies, these relate to the nature of knowledge and the development of that knowledge respectively whilst ontology is specifically how one perceives reality (Sobh & Perry, 2006; Wahyuni, 2012).

Design work is based on a stratified ontology, and stratification is a key characteristic of critical realism. This study was premised in Critical Realism Philosophical view that helps to examine the causal explanations of regularities and irregularities rather than only studying empirical regularities expressed as correlations (Miller & Tsang, 2011: 145). In terms of methodology, Critical realism accepts use of multi-methodological approach, as emphasized by several other Critical Realist scholars (Nunamaker Jr, Chen & Purdin, 1990; Mingers, 1997, 2000; Carlsson, 2003; Pather, & Remenyi, 2004; Venable, 2006; Venkatesh, Brown & Bala, 2013). Moreover, from a critical realist perspective, the adjudication between knowledge claims emanating from diverse theories (theoretical triangulation) is not so much a matter of asking whether different theories are more or less commensurable on ontological grounds, but rather whether they attribute particular causal powers to the mechanisms underpinning observed phenomena in a way that is deemed plausible by particular epistemic communities (Modell, 2015). In terms of complex reality understanding, critical realism underscore the need for variety in terms of methods and theories as a spice of life (Cowper, 1785; Mingers, 2000).

3.3 Justification for Critical Realism as Philosophical Situatedness of the Study

From an ontological view, critical realism suggests that reality is “real” but only imperfectly and is probabilistically apprehensible and so triangulation from many sources is required to understand it (Barab & Squire, 2004: 4; Carlsson, 2006: 192; Easterbrook *et al.*, 2008: 288). It blends use of quantitative or qualitative or multi-methods and participatory action research/interactive research wherein participatory design is anchored. Multiple diverse case contexts across a variety of cases, to give multiple views of phenomena for global decision-making, can be selected under critical realism.

3.3.1 Critical Realist's Stance on Scientific Enquiries

Critical Realism (CR) was developed by Roy Bhaskar in 1975 as a new direction in the philosophy of science and social science, offering a real alternative to positivism and post modernism (Archer *et al.*, 1978). To be a realist is to assert the existence of disputed entities like gravitons, equilibrium, utility and class relations (Carlsson, 2006). To be a scientific realist is to assert that these entities exist independent of our investigation of them (Tsang, 2014). These entities are not something generated during the discourse of our investigations neither are they restricted to the realm of the observable and therefore to be a critical realist is to extend such views into design science (Carlsson, 2006). Based on such arguments, critical realism-based research offers researchers new opportunities to investigate complex organizational phenomena in a holistic manner (Wynn Jr. & Williams, 2012). This is because when engaging with complex communities and organizations, reductionism is seldom an appropriate choice (Bhaskar & Danermark, 2006; Downward, Finch & Ramsay, 2002). Conversely, approaching a study of some phenomena with a degree of institutionalised blindness and shielding social life from stratified levels "beneath" is problematic and inappropriate (Carolan, 2005). Investigating complex organizational phenomena in a holistic manner helps identify the mechanisms that connect chains of indeterminate events and social interactions (Wynn Jr. & Williams, 2012).

Mechanisms identified during any scientific enquiry operate prior to and independently of their discovery (Archer *et al.*, 1978; Tsang, 2014). Our inability to fully know or describe future events does not imply that mechanisms do not exist (Ron, 2002). Critical realism recognizes the reality of the natural order and the events and discourses of the social world and that mechanisms connect events and their social interactions (Fleetwood, 2002). To properly understand the notion of mechanisms, Bhaskar (1989) outlines three domains: the real, the actual and the empirical (Figure 15):

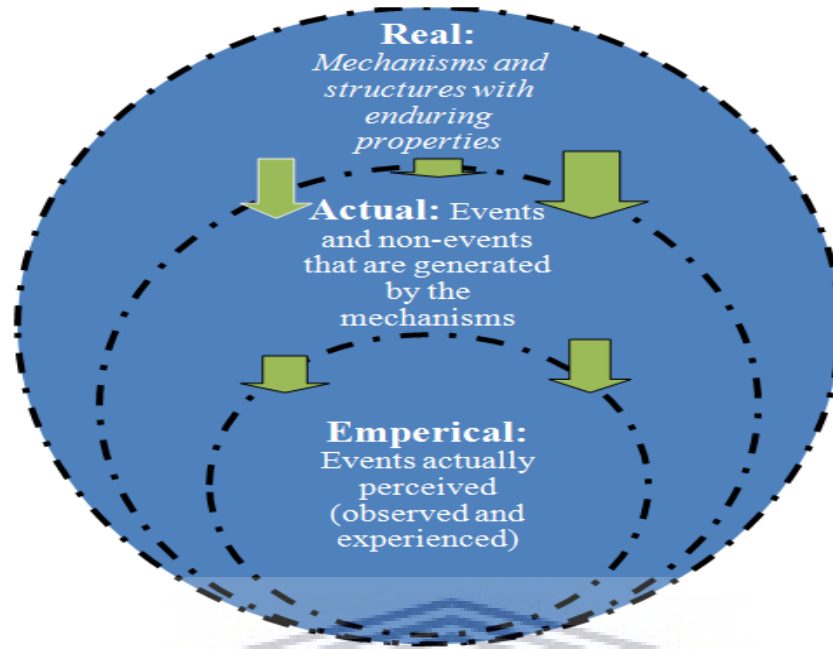


Figure 10: Critical realist's view of science

(Source: Researcher generated from Critical Realism readings)

The real domain consists of underlying structures and mechanisms (observed and unobservable), and relations (events and behaviour and experiences) (Archer *et al.*, 2013). The real or deep structures and mechanisms generate the phenomena (McEvoy & Richards, 2006). The generative mechanisms residing in the real domain exist independently of, but capable of, producing patterns of events (Carlsson, 2006). Relations generate behaviours in the social world (Tsang, 2014). The domain of the actual consists of these events and behaviours or those aspects of reality that occur but may not necessarily be experienced (Ron, 2002). Hence, the actual domain is the domain in which observed events and observed patterns of events occur (Carlsson, 2006). The domain of the empirical consists of what we experience either directly or indirectly; hence, it is the domain of experienced events (McEvoy & Richards, 2006). While we may want to apprehend causal mechanisms during scientific investigations, they cannot be apprehended directly as they are not open to observation. They can, however, be inferred through a combination of empirical investigation and theory construction (Ron, 2002; McEvoy & Richards, 2006; Hedström, 2008). Therefore, an effort to apprehend such mechanisms calls for statistical and causal inferences.

3.3.2 Assumptions of Critical Realism

Researchers approach the world differently to one another. To make a valid choice from varied explanations from different contexts, this study adopts perspectives that are consistent with theory development based on the case study method (Eisenhardt, 1989; George, *et al.*, 2005; Easton, 2010; Tsang, 2014), with key assumptions from a critical realism lens. The aim of this in-depth philosophical scrutiny is to arrive at assumptions that are consistent with the practical world (Ponterotto, 2010). Under this study, the practical world comprises of the design of e-government applications for citizens taking an emancipatory, participatory or democratic design approach while at the same time focusing on contributing to knowledge (Stickley, 2006; Inglis, 1998; Sayer, 1997). I have selected assumptions that integrate and guide the process of this participatory design study using a case study approach and abductive and retroductive theorising for theory development. The following are key critical realism assumptions for this study:

Assumption One: An ontology that assumes that the world exists independently of our knowledge as observers (Sayer, 2000; Swanson & Holton, 2005; Smith, 2006; Easton, 2010; Mingers, Mutch & Willcocks, 2013; Smith & Johnston, 2014). Whereas the world can be socially constructed, the reality is independent of human perception and cognition; this reality has its own inherent order (Viskovatoff, 2000; Tsang, 2014). While we have knowledge and pre-conceptualizations, the world of e-government has objects, entities or subjects available for systematic analysis (Easton, 2010). These entities are assumed to exist independently from the observer and our observations about it can be inherently fallible or illusive – we can approximate the truth, never explaining it perfectly or completely (Mingers, 2004). The objects within the G2C e-government phenomenon may include people, organizations, aspirations, expectations, relationships, attitudes, resources, and ideas that contribute to the basic theoretical building blocks, and which have enduring generative mechanisms operating at various levels. The process of theory-building exists to understand generative powers operating at various levels so as to offer new discoveries of the unknown to the already known (Gray, 2013).

Assumption Two: The world and its subjects have powers, ways of acting and particular influences, either natural or social (Easton, 2010). This study assumes that these powers and influences can be revealed from a participatory approach by cherishing their inherent values. For

example, empowering and engaging citizens and other stakeholders during application design results in effective G2C e-government deployment outcomes.

Assumption Three: The world is differentiated and stratified according to autonomous domains of real – mechanisms and structures that have causal powers and whose generative capacity create the order we see in the world; the actual-events occurring in the world and the empirical – human sensory experiences and perceptions (Bhaskar, 1978; Easton, 2010; Kempster & Parry 2011; Smith & Johnston, 2014; Tsang, 2014). The world of e-government consists of government and IS structures, mechanisms for ensuring adoption and events and strategies for ensuring usage. This ontological assumption is that science can occur in the world based on certain social conditions. For science to occur, the world must exist in a certain way; the world is structured, differentiated, stratified and changing, though the particular structures it contains and the ways in which it is differentiated are matters for substantive scientific investigation (Bhaskar, 2008: 19).

Assumption Four: The epistemological assumption of the critical realism worldview is that while the world is socially constructed, reality always kicks in at some point (Easton, 2010). There is need to uncover the constructions of social actors in order to generate meaning. Tsang (2014) termed these back and forth approaches *abduction* (inference to the best explanation) and *retroduction* (identifying causes and conditions of one's findings).

Danermark, Ekström, Jakobsen and Karlsson (2002) write that critical realism argues that, first, science should have generalizing claims, and second, those social phenomena should reveal the casual mechanisms that produce them. Thirdly, the role of theory is to offer theoretical construct naming for research but needs to be marked as *priori* in theory building studies. Fourth, that research involves a range of methodological tools and one has to utilize those tools creatively in a concrete research project considering ontological and epistemological assumptions underlying them in a multi-methodological way (Mingers *et al.*, 2013). And fifth, that in explanatory endeavours, abduction and reproduction are two important tools (Danermark *et al.*, 2012).

Within Critical realism world view and the fact that it accepts use of multiple theoretical lenses understand a complex reality of designedly work within multimethods, the next section offers a theoretical abstraction model guiding theoretical framework development.

3.4 Theoretical Abstraction Model

Under critical realism, two key strategies to knowledge and knowledge creation are abduction and retroduction as illustrated in the Figure 12:

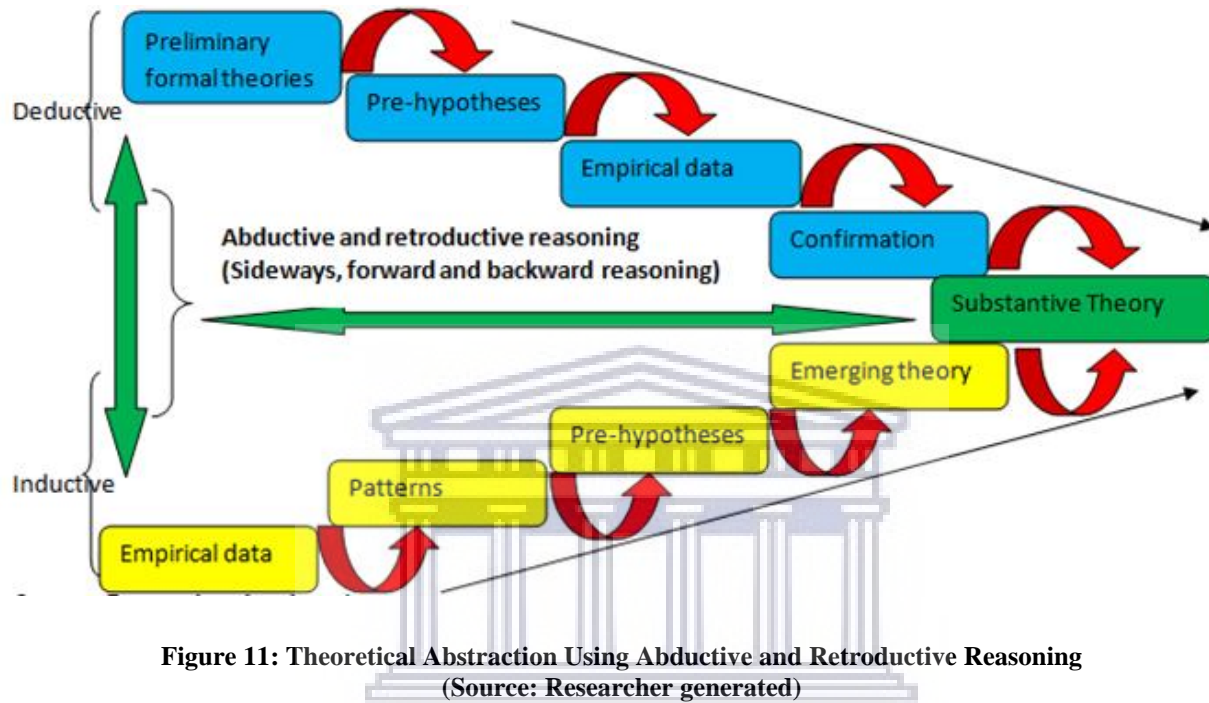


Figure 11: Theoretical Abstraction Using Abductive and Retroductive Reasoning
(Source: Researcher generated)

From Figure 12, theoretical abstraction using a deductive approach is the approach taken by positivists while the inductive approach is preferred by interpretivists (Cavaye, 1996; Gray, 2013; Punch, 2013). A critical realism perspective warrants an approach that takes a middle position for theoretical abstraction (Krauss, 2005; McCall, 2008). This mitigates the weaknesses of one approach while capitalizing on the strength of another. This approach is termed as abductive and retroductive reasoning (Peirce, 1958). The following descriptions of concepts are given as adopted from Latin and further evidenced by Haig (2012):

- a) Retroductive has the prefix “retro”, meaning to move backward; while the suffix “ductive” from Latin “ducere” means “to lead.” Therefore, *retroductive* implies deliberately leading backward with a purpose.
- b) Abductive has prefix “ab” that means “away from” and when combined with suffix “ductive” means “leading away from sideways”.

Such theoretical abstraction in a bid to generate a substantive theory through engaging with formal theories and empirical work is depicted by the green arrows in Figure 11..

Abduction therefore involves analysing data that falls outside an initial theoretical frame while retroduction is a method of conceptualising that requires the researcher to identify the circumstances without which something (the concept) cannot exist (Meyer & Lunnay, 2013).

Our abstraction is exemplified in the following metaphor:

We are like dwarfs sitting on the shoulders of giants. We see more, and things that are more distant, than they did, not because our sight is superior or because we are taller than they, but because they raise us up, and by their great stature add to ours (Merton, 1993: 178, 230).

However, the interest in this study is the applicability of realism rather than any possible inconsistencies of the two (induction and deduction). This is because of the researcher moving “back and forth” from one type of research activity to another and between empirical observations and theory, enabling him to expand his understanding of both theory and empirical phenomena (Dubois & Gadde, 2002; Haig, 2005; Timmermans & Tavory, 2012).

Meyer and Lunnay (2013) opine that by deductive inference, the theory is proved or disapproved, leaving findings that lie outside the initial theoretical lens unattended to. Meanwhile, other theorists who use the inductive approach argue that theories should emerge rather than from imposing an analytic framework *a priori*. Such scientists that use inductive reasoning argue that they do not need to undertake preliminary in-depth literature and theoretical reviews to propose other theoretical frameworks (Timmermans & Tavory, 2012). As per Danermark *et al.* (2012), when using abductive and retroductive theory development, data beyond the proposed theoretical framework is identified and given explanatory power instead of leaving it unattended to. The following are assumptions that guide the theoretical review and theoretical framework development in this study:

- a) The context of a marginalised community setting is key to the design of citizen-centric e-government applications, due to unique user profiles, requirements and needs.
- b) Participatory design is a key underlying mechanism for targeting and understanding behaviour of use or non-use of e-government services which may be determined by underlying beliefs and attitudes of marginalised citizens.

- c) Improved e-government outcomes for marginalised citizens are achievable when the designer's conceptual models are aligned with user's mental models
- d) Judgment and artefact evaluation criteria are guided by intangible non-functional requirements that are influenced by cognitive information processing criteria among the marginalised citizens.

Following the foregoing underlying assumptions, critical realism observes that constructs in theoretical statements need to refer to entities in the real world when developing a research theoretical framework and underpinning (Gregor, 2006). This section reviews theories related to design and adoption in order to reveal theoretical constructs for further guiding the process of knowledge creation based on a stratified ontology. On the onset, most design science research theoretical frameworks are rooted in Design Theory science of the artificial (Simon, 1980).

3.5 Design Theory

Design Theory is a theory of how to do something (Gregor, 2006). It is about principles of form and function, methods and justificatory theoretical knowledge that are used in development of information systems (Walls *et al.*, 1992; Gregor & Jones, 2004; Gregor, 2006; Gregor & Jones, 2007). Most of the design-related theories are anchored in Simon's book (1980) *Science of the Artificial*. Simon's work holds two key assumptions that design of an intellectual structure should aim at accommodating those empirical phenomena that are "artificial" rather than "natural," hence the need to consider human psychology in design. Simon further notes that any system being developed must have a given form and behaviour because they adapt or are adapted, in reference to goals or purposes to their environment. Whereas design theory can be used in various disciplines like art, music, architecture and engineering, this entire chapter situates it in relation to information systems design. A number of design related theories have been advanced within varied philosophical orientations and Table 10 summarizes the theoretical conceptualizations in order to inform the type of design theory appropriate for this study.

Table 10: Contemporary Information systems design theories

Design Acronym	Expansion	Conceptualization
DSRIS	Design Science Research in Information Systems	An information systems research methodology in which new knowledge is produced by the construction of artefacts informed by practice based insight or theory; evaluation of artefacts using human information processing criteria and reflection on the process and implication of design outcome (empathetic design).
ISDT	Information Systems Design Theory	Conceptualised as a set of prescriptive statements describing how a class of artefacts should behave and how they can be constructed, why the artefact behaves the way it behaves and under what circumstances.
DREPT	Design Relevant Explanatory/Predictive Theory	A type of theory that augments the “how” information content of the traditional ISDT with explanatory information why the artefacts has the effects it exhibits. The explanatory information may borrow theoretical information from other disciplines.
ISDST	Information Systems Design Science Theory	This perspective argues that IS is a socio-technical discipline and that design science research must acknowledge that design is fundamentally a human activity
PCT	Personal Constructs Theory	This is a human information system processing model that espouses that humans make value judgment using extremes of bipolar constructions (negatives vs positives). It elicits perceptions of intended system users without designer and researcher bias.
SAT	Situation Awareness Theory	This elaborates the PCT by observing that construct naming during artefact evaluation is beyond perceptual human information system processing to comprehension and project within a given situation and context. The perception, comprehension and projection later guide decision and actions taken by individuals.
CMOC	Context Mechanism Outcome configuration	A critical realist’s artefact evaluation framework for examining whether a designed solution works, for whom and under what circumstances.

As has already been noted in the foregoing sections, all the above theories have been premised on Simon’s work: Walls, Widmeyer and El Sawy’s (1992) building of an Information System Design Theory for vigilant Executive Information Systems; Hevner and Chatterjee’s (2010) Design Science Research in Information Systems; Design Science Research by March and Smith (1995); Kuechler and Vaishnavi’s (2008) Design Science Research in Information Systems; and

Carlsson's (2006, 2010) Information Systems Design Science Research. Philosophical problems associated with building a unified and coherent cross-disciplinary body of knowledge and theory associated with designing and designs have been observed (Love, 2000; Love, 2002). From all the design theories reviewed, Information Systems Design Science theory by Carlsson (2006) candidly offers defence and relevancy as to why design work should be situated within Critical Realism lens.

3.5.1 Information Systems Design Science Theory (ISDST)

Based on some of the documented theoretical limitations, Carlsson (2006) builds on McKay and Marshall (2005) who argue that IS is a socio-technical discipline and that design science research must acknowledge that design is fundamentally a human activity. Carlsson emphasizes that context of design and use is critical, and that research paradigms, practices and activities must embrace a worldview or philosophy. Two major gaps filled by Carlsson's ISDST theoretical perspective is situating it under a philosophical paradigm and an evaluation perspective (Carlsson, 2003), which builds on critical realism and realist evaluation (Pawson & Tilly, 1997). From a similar evaluation perspective and meta-scientific theoretical lens, the intention of design science research in this study is answers the questions why and how an IS initiative works, for whom, and in what circumstances. The IS being designed must have the potential to cause the desired change.

To that note, the IS design science researcher aiming at theory building works as an experimental scientist, but not according to the logic of the traditional experimental evaluation researcher. The experimental scientist must trigger the mechanisms under study to ensure that it is active (Bhaskar, 2002). This study is supportive of Carlsson (2006), who revealed that IS design researchers do not perceive that IS initiatives work. It is the actions and non-actions of the intended users that make them work and the casual potential of an IS initiative provides reasons and resources to allow co-design participants to make changes. From an evaluation standpoint, IS design researchers orient their thinking to context, mechanism and outcome pattern configurations (CMOCs) (Pawson & Tilley, 1994; 1997).

3.5.2 Context Mechanism Outcome Configuration (CMOC) and the Theory of Change

Participatory design encompasses a multitude of methodologies and methods all operating under layered contexts (central government level, local government level, community level and individual levels). Isolating design influences at an empirical level (citizen participatory design level) makes it difficult to attribute outcomes to the participatory design processes or other contextual or design features. To handle such complexity, which the previously reviewed design theories ignore, this study leans towards a realist social theory called Context Mechanism Outcome Configuration (CMOC) (Pawson & Tilley, 1997; Pawson, 2006) primarily because it provides a rationale and tools for synthesizing complex evidence from community-based interventions (Jagosh *et al.*, 2012).

Synthesis, during the application of this method, entails assessing the mechanisms generated by participatory design during artefact development since such mechanisms have generative powers that may be observed as outcomes. For instance, in this study, the context of the empirical domain is marginalised communities and the mechanism introduced is assumed to generate motivation, learning and empowerment among the design participants. Such a scenario results in knowledge generation and conversion as participants' tacit knowledge is interwoven into the co-designer teams' explicit knowledge. This results into organization and individual change, hence the notion of theory of change (Funnell & Rogers, 2011; Kail & Lumley, 2012).

The Theory of change was popularized as a way to describe a set of assumptions that explain both the mini-steps that lead to long term goal and the connections between the program activities and outcomes that occur at each step of the way (Weiss, 2000). The theory of change tracks those assumptions through the collection and analysis of data at a series of stages along the way fo final outcomes.

Rogers and Weiss (2007) reveal,

“Now there is an ever-longer list of labels that have been used, not with consistently distinct definitions, including theory-based, theory-driven, theory-oriented, theory-anchored, theory-of-change, intervention theory, outcomes hierarchies, program theory, and program logic,”
(p. 63).

Whereas such a multitude of conceptualizations of theory of change have been provided, Weiss (2000) warns about the traps and challenges in using program theory of change but two major ones to be addressed by this study are:

- Many intervention evaluations are based on an implementation theory and some intermediate outcomes, rather than a programmatic theory that specifies mechanisms of change;
- The conceptual summary drawings of theories of change figures involved in a programmatic theory do not examine the causal mechanisms involved in programs and policies.

To mitigate those two theoretical challenges and limitations, there is need to align the theory of change development to the context mechanism based outcome configuration. It is emphasized that designers and evaluators looking for examples with clearly labeled mechanisms refer to Pawson and Tilley's classic realist example of how closed circuit television in parking lots might work to reduce auto theft through the mechanism detection, capture and removal of thieves; through deterrence ; through passive surveillance among others (Pawson & Tilley, 1997; Tilley, 2000; Rogers & Weiss, 2007).

From the CMOC and the ToC, the key underlying unattended to concept, is that of 'mechanisms based explanations' which will be dealt with fully in the philosophical underpinning chapter. However, here provided is a quick view of mechanisms during intervention design. Mechanisms are ways of acting of things (Bhasker, 1975: 14). They are inherent to physical and social structures, enabling or constraining what can happen within a given context and can be conceptualized as causal powers or tendencies (Wynn Jr & Williams, 2012).

Astbury and Leeuw (2010) offer a clear link between mechanisms and theory building when they highlight the importance of casual mechanisms to explain how and why programs work and under what circumstances. Whereas there is conceptual confusion of relegating mechanisms to the program activity, from a design perspective, mechanisms are conceptualized as the observable or unobservable attributes that bring about the change (positive or negative) in a unit of analysis. They may include motivation, engagement or disengagement, empowerment, enhanced knowledge and awareness, sense of feeling to have contributed to a given cause; also

termed as theoretical mechanisms (Hedström, 2008; Astbury & Leeuw, 2010). These could be explained by some statistics where a researcher may seek to examine the explanatory power of how X may cause Y, referred to as statistical theorizing (Hedström, 2008). The distinction between theoretical mechanisms and statistical theorizing is not part of the debate in this chapter but will be provided later in the methods chapters.

From all of the foregoing design science research theoretical frameworks, one major recommendation is the need to align advances of design with cognitive psychology (Simon, 1996). It is this component of human cognition that comprises another contribution of this study into the space of design science research for theoretical frameworks. Three such well cited theoretical frameworks for IS application design are Socio-Technical Theory, Personal Constructs Theory and Situation Awareness Theory.

3.6 Socio-Technical Theory for IS Design

Within the ambit of Socio-Technical Theory, focus is placed on the analysis of the problem and the formulation of the design process in joint consideration of the technical system requirements and the social system requirements (Bostrom & Heinen, 1977). This type of design process should not only consider procedural aspects of design but also people. Design science research is an essential part of IS research since the field should not only understand how the world works, but also how to change it (Carlsson *et al.*, 2011). Other proponents of the Socio-Technical Theory reveal that the rationale for developing Socio-Technical Design Knowledge and Theory is that such knowledge and theory can support practitioners in understanding which mechanisms lead to desired outcomes (Dillon & Morris, 1996; Luna-Reyes *et al.*, 2005; Lyytinen & Newman, 2008).

The cornerstone of the socio-technical approach is that the fit is achieved by a design process aiming at the joint optimization of various organizational layers. Furthermore, any organizational system maximises performance only if the interdependency of the layers is explicitly recognized (Cartelli, 2007). Hence, any design or redesign must seek out the impact which each sub-system has on the other, and planning must aim at the achievement of superior results by ensuring that all the sub-layers are working in harmony while guided by design theories. Design theories should be enhanced by being grounded in previous research and knowledge (Wang & Hannafin,

2005). The extant literature maintains that design theory should be enhanced by continuously interacting with what is currently known – that is, grounding in relevant available theories together with practical knowledge (Carlsson *et al.*, 2011). In such theories, knowledge and data are important to draw upon the widest possible range of resources when conducting design science research (March & Smith, 1995; Gregor & Hevner, 2013). Theories can be substantive theories or more general theories. Like the previous theoretical frameworks, this study contends that theories from natural science and social science can be used to govern design science research (Bostrom & Heinen, 1977; Walls *et al.*, 1992; Hevner *et al.*, 2004; Carlsson *et al.*, 2011; Gibreel & Hong, 2017). In terms of evaluating design science outcomes, Bostrom and Heinen (1977) have revealed that information design outcomes are evaluated using bipolar constructs termed the Personal Constructs as advanced in the Personal Constructs Theory (PCT).

3.7 Personal Constructs Theory (PCT)

While a number of design science research frameworks exist in the IS field, there has been contention about the criteria for artefact evaluation (Peppers *et al.*, 2006). The central theme of Personal Constructs Theory is that people organise their experiences that form their knowledge about the world into conceptual classifications (Hawley, 2007; Alexander *et al.*, 2010). These classifications can be differentiated and described using attributes called constructs (Kelly, 1955; Wright & McCarthy, 2004). These constructs manifest themselves as polar opposites on a scale, allowing for the organization of the elements of our world (Kelly, 1955). Kelly's approximation of events and constructs is that there is a real world of events beyond our comprehension, one that would exist even if humankind had never graced the earth (Butt, 2004).

Kelly's Personal Constructs Theory (1955) and its cognitive mapping tool have been applied in previous studies during the design and deployment of new information systems in a participatory manner. These include Hunter and Beck (2000), who conducted a cross-cultural study of information systems; Wessler and Ortlieb (2002), who undertook a user-centred approach to measure a Website's Appeal using RepGrid; Tan and Hunter (2002), who measured cognition in information systems; and Napier, Keil and Tan (2009) who investigated IT project managers' construction of successful project management practice.

Kelly's underlying principle in the Personal Constructs Theory is that he does not advocate a degree to which our perceptions of the world are accurate but instead advises that we should continue our search into what we yet do not know, sometimes blindly, but with courageous imaginative daring. For instance, Kelly (1955) notes:

“If a man, say psychologist, remains aloof from human enterprise, he only sees what is visible from the outside. But if he engages himself, he will be caught up in the realities of human existence in the ways that would never have occurred to him. He will breast the onrush of events. He will see, he will feel, he will be frightened, he will be exhilarated, and he will himself be feared, hated and loved,” (p. 46).

Tan and Hunter (2002) argue that understanding the assumptions, expectations, values and beliefs of stakeholders within a case can lead to more successful information outcomes. This is because making sense in organizations begins with the personal initiatives that individuals use to understand and interpret events around them. People build schema, cognitive maps, boundaries, mental models and a variety of other cognitions. This set of perspectives is referred to as a system of personal constructs and these personal constructs can be shared to a greater or lesser extent in organizations (Kelly, 1955).

The following comprises the key tenets from socio-technical theory and personal constructs theory:

- Socio-technical theory focuses on the analysis of the problem and the formulation of the design process in joint consideration of the technical system requirements and the social system requirements. This type of design process not only considers procedural aspects of design, but also people and change processes, (Davis et al., 2014).
- Design science research is an essential part of IS research as the field should not only try to understand how the world is, but also how to change it in a meaningful way (March and Smith, 1995).
- The only component that is not well elucidated is the timing of artefact evaluation either before, during or after design research task, (Venable *et al.*, 2016).

- Social technical theory perspective results into conceptual modeling that involves the understanding and communication between system analysts and end-users. Human cognition, which could be a limitation of the socio-technical perspective plays a pivotal role in the cognitive mapping techniques that are effective tools to elicit user constructs (Siau & Tan, 2005).

From the foregoing discussion, PCT mitigates a socio-technical theory limitation by revealing that each individual has his or her own unique set of constructs that can be used to judge a designed product by the users (referred to as marginalised citizens in this study). Constructs that form the knowledge bases can be regarded as less important to one individual while the same constructs are important to another. The sum of an individual's unique constructs contributes to their different perceptions of the world and their behaviour. Personal Constructs Theory is influenced by the users' artefact situation awareness.

3.8 Situation Awareness Theory (SAT) and Mindfulness Theory

Situational awareness, represented in Figure 13 (Endsley, 1995) below, incorporates almost all variables involved in a comprehensive theory of human behaviour, with particular attention to its cognitive elements (Bedny & Meister, 1999). The focus of this study is to find a position for participatory design as a triggering mechanism (*green arrow incorporated by researcher*) for targeting user behaviour and examining how it can be used to address contextual issues (situation analysis), use artefacts to assess cognitive criteria, examine resultant changes in decisions along the co-design process and address the expectations-experience results.

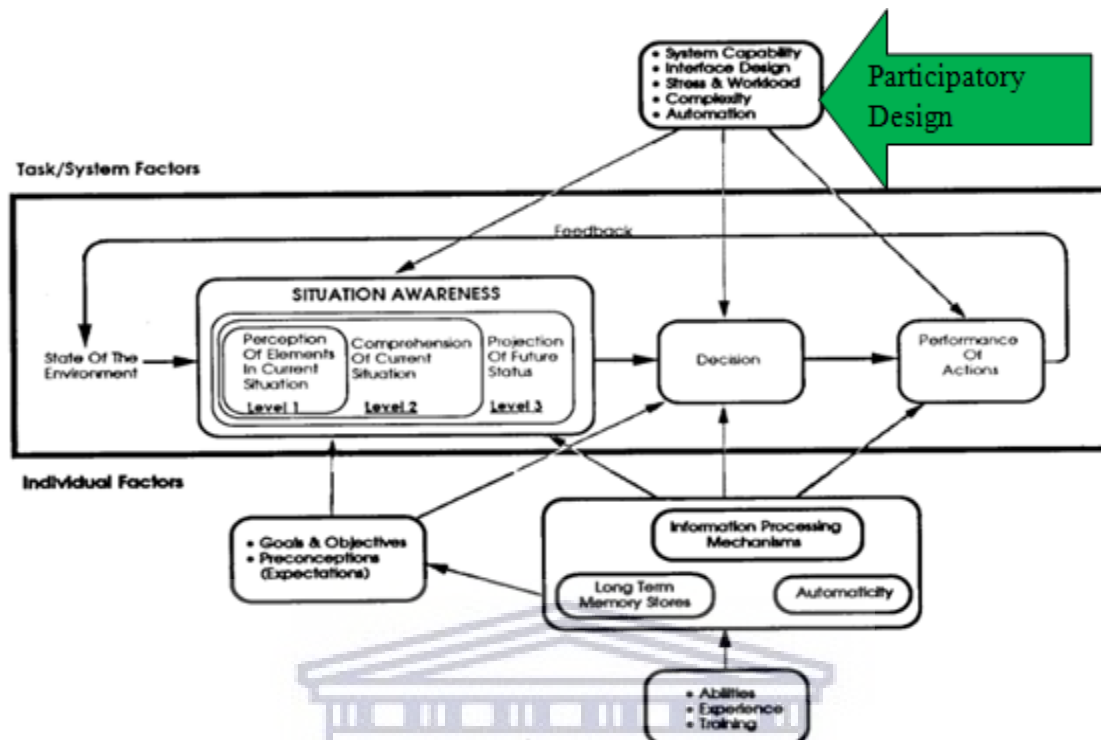


Figure 12: Situation Awareness and Participatory Design
(Source: With Modification from Endsley, 1995)

Figure 13 above represents how the state of environment influences how we perceive different situations, how we understand the current situation and how we project future solutions in order to take action. Perception, comprehension and projection are the situation awareness cognitive criteria that have explanatory sub-constructs. They dictate the kind of decisions one makes and the ultimate action performed. From a design perspective, it is hypothesized that participatory design has the ability to harmonize situation awareness constructs, individual factors, task/system and contextual factors. This is because such constructs can trigger a user's observed and unobserved mechanisms within a given context. These mechanisms lead to a decision by a user to perform the actions needed. Specifically, situation awareness under this study aligns well with CMOC as follows:

- a) The mechanism is the participatory artefact design that can result in other generative mechanisms (observable and/or unobservable).
- b) Context is the situation under design.

- c) The cognitive mapping of perception, comprehension and projection can help form the personal constructs of a designed interface.

Cognitive mapping relates to Kelly's personal constructs, which every individual develops when making a decision.

From such cognitive mapping, theories and models have been advanced as those notably discussed in the foregoing sections of situation awareness theory (Endsley, 1995) that calls for being design mindfulness as originated by Jon Kabat-Zinn in 1979. Mindfulness theory is similar to Situation awareness theory in that it calls for paying attention on purpose in the present moment, and being non-judgementally during any intervention design process (Kabat-Zinn, 2011).

A number of scholars have used situation theory, mindfulness theory and similar cognitive theories for user interface design and have recommended them as a means to improve the design of prototypes and artefacts that meet both functional and non-functional qualities of users. These authors include Kuechler and Vaishnavi (2008); Parasuraman, Sheridan and Wickens (2008); Rosli, Hassan, Rahman and Alias (2012); and Vaishnavi and Kuechler (2015). This is because design science research *intersection approach* accepts any concept from any field if it appears to add insight and explanation to information systems practice and research. The *core approach* seeks to define those ideas that characterise the discipline and make it distinct. An understanding of personal constructs that can be generated within a given situation during information systems design process enables designers to create user-centred designs. Hence, the gist of this study is to develop a theoretical framework to design an e-government application from a user-centred perspective (situation aware, design mindful and aware of that user's develop their own personal constructs), hence the notion of user-centred design.

Kelly's personal constructs theory and situation awareness theory capture most of the cognitive constructs that are peculiar among technology adoption and e-government studies. Such theories as provided in the appendix include: Cognitive Dissonance Theory (CDT) that observes that the individual strive towards consistency which co-exists with self-inconsistencies (Festinger, 1962). A reduction of dissonance may occur when an e-government user interacts with others who would agree with and support or improve the user's position by meeting their expectations in a collaborative manner (Ausubel, 2012). The meeting of such expectations to yield satisfaction of

the user is well articulated in Expectation Disconfirmation Theory (Oliver, 1980) and is rooted in Cognitive Dissonance Theory (CDT) fore reviewed. EDT involves four primary constructs: expectations, perceived performance, disconfirmation of beliefs and satisfaction. The outcome of satisfaction in respect to an e-government application may be of effective or ineffective use. Since expectation is a key construct in the theory, early collaborative design (or co-design) may be a precursor for an early judgment of the e-government artefact by the affected stakeholders. In a similar way, ICT adoption models based on user expectations may explain satisfaction of usage of e-government applications as an outcome. Another relevant theory is the Theory of Planned Behaviour. Other similar theories used to study adoption include: Technology Acceptance Model (TAM) (Davis, 1985, 1993), Extension of a two stage information systems continuance model to TAM due to the contextual nature of IS studies and UTAUT (Venkatesh, Thong, Chan, Hu and Brown, 2011), psychology empowerment theory (Zimmerman 1995), capability theory (Sen, 2005) among others. Simon emphasized that the advances of design need to be aligned with cognitive psychology as well (Simon, 1996). For instance, in terms of less tech savvy's use of e-government, pre-usage beliefs and pre-usage attitudes predict intention to usage which in turn affects actual usage and adoption (Venkatesh *et al*, 2011). Details are provided in the appendix.

These theories have been applied in various studies to explain the phenomenon of technology adoption. They intend to explain particular instances of the phenomenon, most of which relate to mandatory use, rather than all possible usage occurrences including voluntary use which is a key usage characteristic of marginalised people (Kontos & Poland, 2009). Since most of the aforementioned theories are used as predictive theories, offering pointers to the perceived system usage and adoption in mandatory contexts, in this study, such theoretical constructs are considered '*a priori*.' Whereas they are not discarded, they were candidate theoretical framework for naming the emerging constructs during the participatory design research process. Some offered a lens for evaluating the artefacts developed during the co-creation process.

3.9 Proposed '*a Priori*' Process Theoretical Model

There is universal acceptance of the role of participatory design in yielding desirable usability outcomes of the designed artefacts. For instance, adoption and usability is a function of design-related issues and design-related gaps. The interaction between designers and users helps reveal

observable and unobservable events and, within mechanisms, there are casual powers that must be explained in a dialectical manner. However, the challenge that remains is to develop a feasible co-design approach (whether research through design, research into design and research for design) to develop an e-government for citizen application that bridges the design-reality gaps in a novel way. From the available body of knowledge so far reviewed, it can be concluded that most design studies have concentrated on “designing the design research” as opposed to “researching the design research processes” through design, into design and for design.

Park and Park (2014) summarize that for more than 40 years of design research, since Churchman and Schainblatt (1965), designer user interaction has had two major problems:

- a) Established design vocabularies (research design, methodologies and approaches) have not adequately documented how designers could invite users and interact with them in the design process.
- b) Most IS researchers and practitioners have focused on IT radical innovation and not interactive (“co-design”) design innovation methodologies.

Figure 14 illustrates a process hypothetical model based on the British Design Council (2005) double diamond model. Participatory design involves the interplay of various stakeholders who have varied mandates, aspirations, mental models, mind maps, emotional reactions and other non-spoken information resulting in cognitive divergences and convergences. In order to have successful design outcomes, such varying expectations need to converge at some point in time.

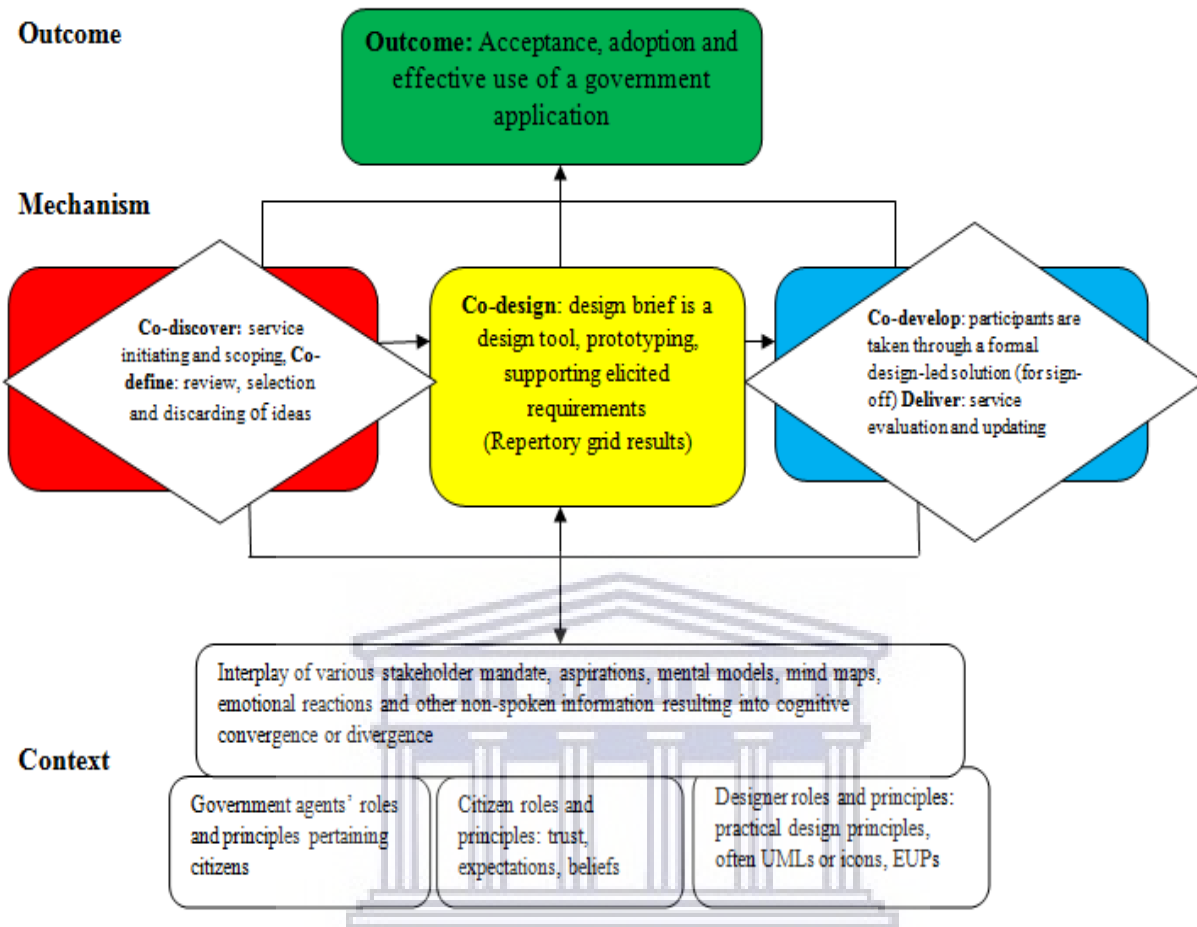


Figure 13: Juxtaposition of Participatory Design
(Source: Researcher generated)

The e-government citizen-centric participatory design model (Figure 14) depicts the ontological hierarchy of the world of government with mechanisms and structures to form the real domain. Citizens' and designers' ontology are also represented. The citizen has various roles and principles that have to be aligned with capabilities. The designer too has roles and principles. The designer and the citizen have to enter the same design space from their two worlds and reach a shared ontology governed by the ontology of real (government) that does business based on structures, systems and processes as dictated by national priority plans. Drawing from British Council Design School of Thought (2005); Bell and Nusir (2017), Stelzle, Jannack, and Noennig, (2017), the first stage in application development is "discover", which in the above model is termed "co-discover". The second stage is "define", which I term "co-define". The third stage is "develop", which I term "co-develop". This is where potential solutions are proposed. The final

stage is “deliver” which I term “co-deliver” where the solution that works for a particular group of people under given circumstances is targeted.

During the design process, it is assumed that there are varying aspirations (mental models of citizens, conceptual models of designers and structural and institutional mindset of government officials). They all must be aligned and reach convergence or consonance if a successful design outcome is to be realised. Most critical of all, though, are the unspoken aspirations (mechanisms) observed by neither participants in their respective worlds. This implies the design has to devise strategies beyond the generic strategies of “talk and listen” to “make and observe”. This conceptualization of organization problems that devises solution while focusing on desired outcome has been popularized in theoretical literature as context mechanism outcome configurations (Pawson & Tilley, 1994; Pawson & Tilley, 1997; Pawson, 2006; De Souza, 2013) and theory of change (Quinn & Cameron, 1988; Funnell & Rogers, 2011; Taplin & Clark, 2012). These have been dealt with explicitly in the previous theoretical review sections. However, these theoretical issues’ concern while focusing at desired outcome is to arrive at problem solution convergence between solution thinkers and solution users.

Once convergence is realised, the expected outcome of usability of e-government applications will be realised. The researcher emphasises that all the available design and adoption models and frameworks were considered *a priori* to offer theoretical constructs of the study. So long as they did not fit the collected data, they were discarded with accompanying justification in the conclusion of this thesis. The construction of the theoretical lenses to guide the study drawn from other existing multidisciplinary theories need to be anchored in a philosophical world view, so that the methodology and methods, to have a firm grounding.

CHAPTER FOUR

METHODOLOGY AND METHODS

“Variety is the Spice of Life,” (William Cowper 1785, in John Mingers, 2000).

4.1 Methodology

Based on Babbie and Mouton (2001) offer a Three Worlds framework to analyse research methodologies and methods, this study was premised in Critical Realism World View. Design work and design methods involve a number of stakeholders with multiple view points coming together to enrich the design space. For instance, Yucel (2018) observes that critical realism helps such diverse stakeholders make sense of how socially constructed scientific knowledge can be anchored in an independent reality. Moreover, Mingers and Willcocks (2014) assert that critical realism as a study world view offers a framework to help analyse the complex interactions between three different worlds (stratified ontologies)– the personal, the social and the material. Due to critical realist’s stratified nature of reality within which design takes place, and the socially constructed scientific knowledge anchored in an independent reality, the research methodology and methods for this study was based on Babbie and Mouton’s (2001) Three World perspective with critical realism as a meta-theoretical anchor offered in table 11 below.

Table 11: Relationship between meta-science, science and everyday life



(Source: Modified from Remenyi, Pather & Klopper, 2011)

This study's interest resides in World One, where everyday problems are situated. However, to clearly investigate World One problems (green), the investigation must be situated within a World Three philosophical lens (red) and World Two paradigms and methods (yellow). At that level, the problem is defined and the research question established. Within World 2, the methods for answering the research question and contributing solutions to the problem are devised. These must be dictated by the nature of the research question and should be well-situated within World 3 (philosophy of science based on critical realism) to ensure the theoretical validity of the study. From a critical realist's view, it is the empirical domain where events generated by deep mechanisms are actually perceived (observed and experienced). The situating design sciences research within a philosophical lens of critical realism help to candidly study and understand the "messy problems" for more in-depth analysis. For instance, Byers, Hayday and Pappous (2019) note that wicked problems require a Critical Realist's perspective, which serves to give meaning and order to a complex process. Moreover, critical realism helps to study and understand more complex problems (Heeks, Ospina & Wall, 2019) as it supports multiple methods as is the case for design science research (Heeks & Wall, 2018).

4.2 Research Design

Research design is a blueprint for conducting a proposed study (Babbie and Mouton, 2002: 74). This is an empirical study involving a collection of primary and secondary data from the field. It is a participatory action research design involving the use of multiple case studies, herein referred to as *multimethodology* (Mingers, 1997, 2000). In multimethodology researchers opine that research methods are never wholly internal to a single paradigm, rather it is quite possible to disconnect a particular method from its normal paradigm and use it, consciously and critically, within another setting (Mingers, 2001). For example, the use of quantitative data need not imply that the study is premised on a positivistic and objectivist epistemology. Rather, such data can (and should) be interpreted in the light of relevant social meanings, and their production as a social construction (Smaling, 1994; Mingers & Brocklesby, 1997; Mingers, 2001). For this particular study, the rationale for multimethodology is premised in a number of structured dimensions, viz. the researcher, the co-designer team members, the concrete object of study

(research through design), the research situation (marginalised communities), the research question (concerning a feasible co-design methodology), the relevant audiences, conditions and circumstances and the time-dimension (Smaling, 1994). The overall goal of this study is the development of a feasible design framework for development of G2C applications aimed at bridging the design-reality gaps among e-government citizen services. Such a research goal cannot not be hooked to a single paradigm due to its complexity.

4.2.1 Participatory Action Research Design

Participatory action research (PAR) emerged to render development assistance more responsive to the needs and opinions of the local people as an alternative to projects usually implemented in a technocratically and in a top-down manner (Babbie & Mouton, 2002: 314). The participatory design this study adopted was formed in Scandinavia in the 1970s to democratically empower workers by allowing them to determine and scope the new technologies introduced to the workplace (Spinuzzi, 2005). However, the scope of this study is not to trace democracy and participatory action research but to adopt and adapt its ideologies and principles relevant to this study. Some essential principles observed in this study's design are among the following:

- The researcher takes a role as a participant and a change agent;
- Great importance is accorded to participants' engagement;
- The relationship between the researcher and participants is democratic in nature;
- Local knowledge is incorporated into the research; and
- There is respect of participants' interests and culture (Babbie & Mouton, 2002: 314).

Selener (1997: 20) offers support for PAR by asserting that community participation in the research process facilitates a more accurate and authentic analysis of social reality. This study was a blend of southern tradition committed to working with grassroots groups to promote fundamental social transformations' and northern tradition which is which is focused on organizational reform (Healy, 2001; Babbie & Mouton, 2002: 315). This blend is employed because the field of e-government involves participation of the elites at national level (which the southern traditions exclude) while simultaneously working with the typical citizens as users of systems (which the northern tradition elites overlook) (Wallerstein & Duran, 2003). This study

therefore includes policymakers and leaders that are critical to the development of e-government policies and applications. Moreover, from an information systems perspective in general, and design science research in particular, PAR has been recommended to offer practical relevance to IS research.

In regard to averting the struggle of researchers towards relevance, Benbasat and Zmud (1999) advise that colleagues who prefer to see the world through other lenses (e.g. advocates of ‘action research’ or PAR, are likely to offer their own approaches to attain relevance. Baskerville and Myers (2004), too, emphasize that the rationale of action research need to be premised on practical relevance by ensuring:

- a) purpose of any action;
- b) practical action in the problem setting;
- c) action that informs and is informed by theory (Dick, 2004; Blichfeldt & Andersen, 2006); and
- d) reasoning and action that is socially situated (Baskerville & Myers, 2004).

In summary, this study takes a participatory design science research approach, as advanced by McKay and Marshall (2005) and supported by Carlsson (2006). It states that IS is a socio-technical discipline and that “design science research that builds a body of knowledge must acknowledge that it is fundamentally human activity systems which are usually technologically enabled, implying that the context of design and use is critical” (Carlsson, 2006: 194).

4.2.3 Design Science Research Methodology

Vaishnavi and Kuechler, (2015) clearly distinguish between design, design research and design science research. This is useful as many authors have used such terms interchangeably. For example, Collins, Joseph and Bielaczyc (2004), in their paper *Design research, Theoretical and methodological issues*, while highlighting methodological issues, make no mention of design science research and admit to using the words *design research* and *design experiments* interchangeably. Venable (2006) clearly distinguishes between design science (research), design practice and design itself. This distinction of terms is crucial to any similar study.

Design as a method means to undergo a process and a sequence of activities viz "to invent and bring into being" (Manson, 2006). Thus, design deals in creating a new artefact that does not exist (Sein *et al.*, 2011). If the knowledge required for creating such an artefact already exists then the design is routine; otherwise, it is innovative (Gero, 1990; Leonard & Rayport, 1997). Innovative design may call for the conduct of research (design science research) to fill the knowledge gaps and may result in research publications or patents (Vaishnavi & Kuechler, 2015). Simon (1996) roots design as a science by advancing natural science and science of the artificial which he distinguishes as,

a natural science is a body of knowledge about some class of things – objects or phenomena – in the world (nature or society) that describes and explains how they behave and interact with each other. A science of the artificial (design science), on the other hand, is a body of knowledge about the design of artificial (man-made) objects and phenomena – artefacts – designed to meet certain desired goals (Simon, 1988: 111).

Design science, then, is knowledge in the form of constructs, techniques and methods, models, well-developed theory for performing design mapping – the know-how for creating artefacts that satisfy given sets of functional requirements (Jonassen, 2000; Sein *et al.*, 2011). Design science research is research that creates this type of missing knowledge using design, analysis, reflection, and abstraction (Vaishnavi & Kuechler, 2015). Whereas this study holds a similar position with Venable (2006) (that design science is ‘technology invention’ and design practice is ‘technology application’), I further contend that design science and design practice can result in design science research which I term under this study ‘research through design’.

Design science research is a ‘lens’ or set of synthetic and analytical techniques and perspectives for performing research in IS (Vaishnavi & Kuechler, 2015). Design science research involves two primary activities to improve and understand aspects of information systems:

- a) The creation of new knowledge through design of novel or innovative artefacts (things or processes); and
- b) The analysis of the artefact use and/or performance with reflection and abstraction (March & Smith, 1995; Vaishnavi & Kuechler, 2015).

Design science research, by definition, changes the state of the world through the introduction of novel artefacts. Whereas design research methods position information systems artefacts at the core of the information systems discipline, most design thinking studies pay scant attention to the shaping of such artefacts by community contexts (Sein *et al.*, 2011). Most design research methods focus on building artefacts and relegate evaluation to a subsequent and separate phase (Van Aken, 2004; Carlsson, 2006; Sein *et al.*, 2011). This study contributes to the mitigation of this challenge by placing citizen evaluation of the evolving artefact at the core of the design methodological processes. I agree with design worldviews that design research has much in common with critical realism-based evaluation research of social programs (Van Aken, 2004; Carlsson, 2006).

Critical realism can be best suited to underpin design science research because of its critical and emancipatory component (Carlsson, 2006; Wilson & McCormack, 2006). By incorporating artefact evaluation activity into the design research methodology, I argue for the need to produce ever more detailed answers to the question of why and how an IS works, for whom and in what circumstances. Critical realist evaluation has named this *context mechanism outcome configuration* (Pawson & Tilley, 1997; Jackson & Kolla, 2012; Jagosh *et al.*, 2012; de Souza, 2013). Where emancipatory tendencies exist, the context mechanism outcome configuration of the realist social theory is crucial (Pawson & Tilley, 1997). As outcomes, design science research offers the following products: constructs, models, methods, implementations and theories. The vital activities are building or constructing the artefact and evaluating it to assess how well it can be used to perform the indented tasks (March & Smith, 1995, Simon, 1996). In summary, Carlsson (2006) has noted that using the context mechanism outcome framing implies that a design team attends to how and why an information system initiative has the ability to cause the desired change. Such a change from the current lived experiences of the citizens is the real pointer to the design-reality gaps this study seeks to fill.

4.2.4 Research Through Design Methodology

Design science research methods offer the potential for learning through building and evaluating artefacts while improving community problems through advancing solutions (March & Smith, 1995; Benbasat & Zmud, 2003; Carlsson, 2007). Due to the importance of design science methods, authors like Simon (1996) encourage professional schools to reinstate it in their

curricula to reclaim professional responsibilities and ensure that the science of design consists of intellectually tough, analytic, and teachable doctrine. Such analytical procedure through a creative iterative process has the potential to arrive at the root causes of the mismatch between user mental models and designer conceptual models. Zimmerman and Forlizzi (2008) among other scholars have called for a revolution in design research that can advance beyond current forms of design practice and research on design methodology. Such assertion therefore calls for a rethinking of the traditional linear design practices to design thinking principles. To understand the full design research process harnessing design thinking, figure 16 below was used.

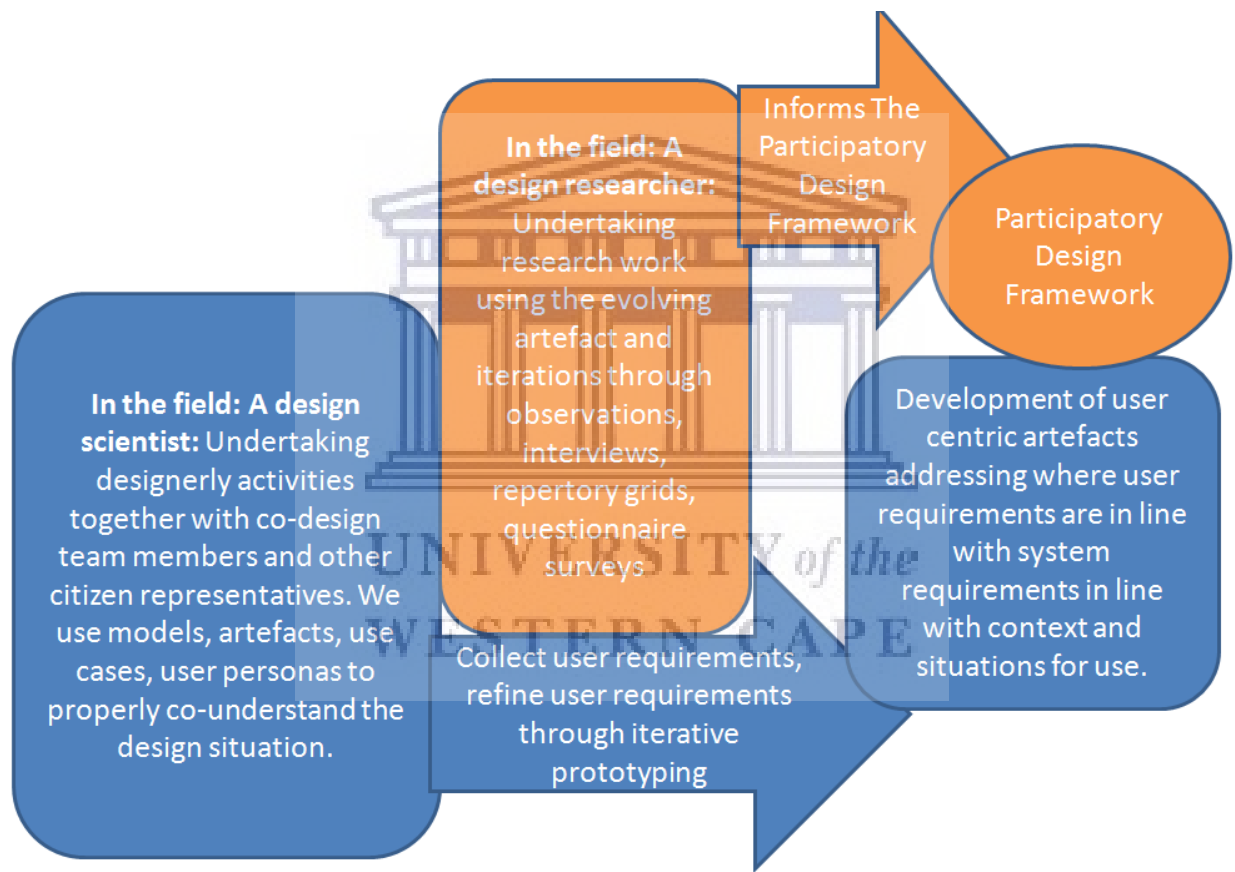


Figure 14: Iterative Parallel Participatory Design Research Framework

In Figure 16, the assumption is that the research and design work takes place concurrently. In the field, co-designers are both researchers and developers. As researchers, they harness tools for empirical research, using the design activity as a method or strategy for generating data through the evolving artefact. This refers to learning through building artefacts in an iterative form.

4.2.5 Iterative Design Science Research Model

Specifically, whereas the aforementioned framework is a high-level representation, the actual design and research methods adopted were guided by an iterative co-design research model, constructed from design thinking principles of the UK double diamond model (Tschimmel, 2012) to reveal points of convergence and divergence in relation to the design process. In the divergent mode, the co-design team openly identifies all views, problems, and potential impacts of the intervention being planned. In the convergent mode the team hones in on viable scenarios for users to create buy-in amongst stakeholders. Figure 17 depicts the actual processes involved through DSR1-DSR4.

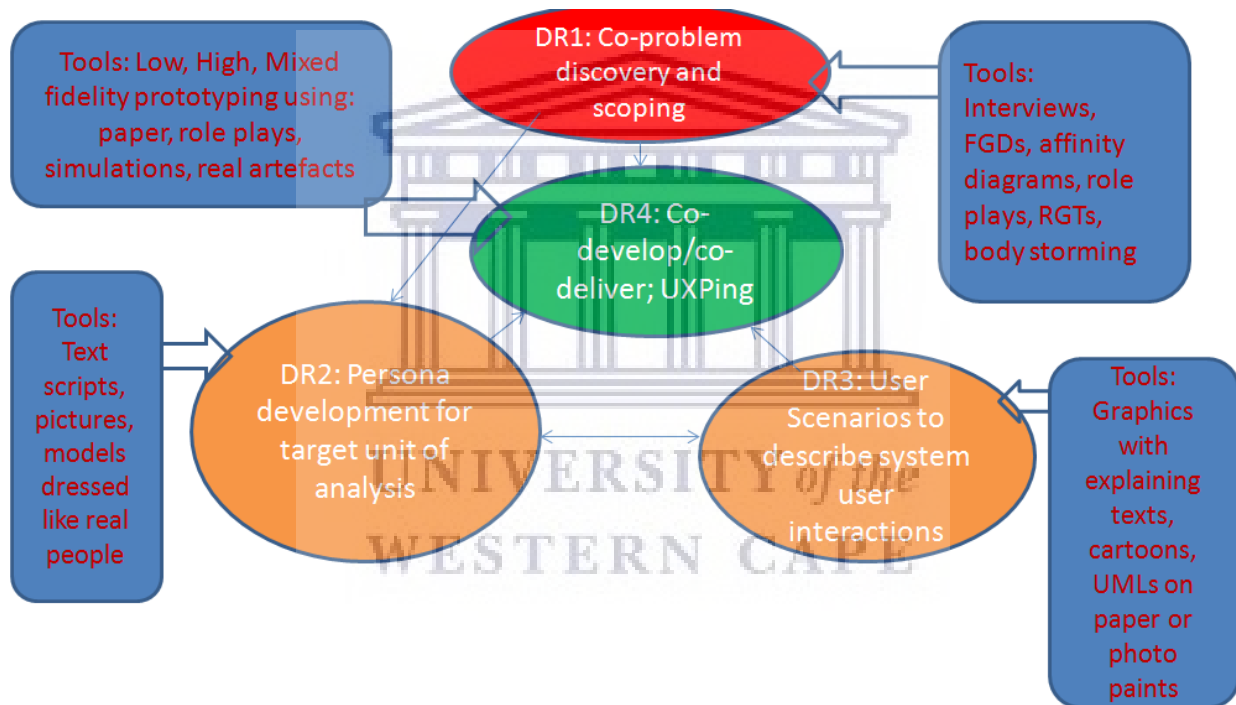


Figure 15: Iterative Design Research Model (IDeRe Model)

This model is premised in the Double Diamond model that highlights iterative design steps of problem discovery, problem scoping, solution design and solution delivery. The authors, while premised in participatory design frameworks undertook major design iterations in-house with design team and refers to as co-design while at the same time assessing the artefact among the citizens to examine their experiences. Both tacit and explicit knowledge was generated during the ongoing design and evaluation that was then integrated into the design process, culminating

in the development of the co-design framework, which is the main output of this study. Below is an overview of the four design science research (DSR) processes and their inherent methods that were proposed. A description of the methods that worked and those that failed is reported in the findings chapter of this thesis. The four phases of design science research described below involve the following role-players:

The lead researcher offers mechanistic explanations, emergence, simplifying assumptions, and providing abductive reasoning from practice and theory (Miller, 2015). The lead researcher serves as a mature adult designer with highly formalized knowledge and experiential tacit knowledge to gatekeep the design processes (Bovill & Bulley, 2011; Bovill, Bulley & Morss, 2011).

Design team members act as: potential system users (who can be observed or assessed); as testers; as informants (who offer feedback and input); and design partners (considered equal stakeholders in the design process) (Druin, 2002; Druin, 2010).

Citizens are selected not as representative cases for the basis for generalization, but as critical or extreme potential system user cases for system usability experiencing during the design process. All citizens in a marginalised context are considered potential e-government application users; therefore, selected agents among the various citizen social phenomena were to be observed to investigate any critical events that cause or answer the design and system usability related questions (Wahyuni, 2012). Such individual mechanisms could have considerable consequences for aggregate social outcomes that a group of individuals is likely to generate (Hedström, 2008).

4.2.5.1 Design Science Research (DSR1)

The point of departure at this stage is to ascertain a class of problems that affect marginalised communities and thereafter scope them through interactive processes. The problem discovery phase is the first stage where problems from a user perspective are perceived in practice based on their lived experiences. It provides the impetus for formulating the research effort. It is noted that the input for this formulation can come from practitioners, end user communities, the researchers, existing technologies, and/or review of prior research (Sein *et al.*, 2011). Some scientists have argued that the problem formulation stage identifies and conceptualises a research opportunity based on existing theories and technologies (Hevner *et al.*, 2004). While all

approaches previously mentioned could apply, this study ensures that long-term commitment from the participants and co-defining the problem was maintained through the critical realist lens.

From a critical realist perspective, the principle researcher or designer, during co-problem discovery needs to act as an experimental scientist by triggering the mechanism under study to ensure that it is active (Bhaskar, 1998; Carlsson, 2006). At the problem discovery and scoping level, the researcher establishes causal powers by asking what makes things in the community happen or not happen, what produces, generates, determines or leads to the various community problems (Sayer, 1994: 104; Easton, 2010: 120). From the participants, the aim is to stimulate thinking about e-government that citizens find acceptable to their realities rather than imposing problems from the researcher's intuition and *priori* theoretical frameworks. In addition, there is a need to discover events among citizens. These are external, visible and invisible behaviours of people, systems and things as they occur (Easton, 2010). Such lived experiences, behaviours and attitudes, because they are real, can be co-discovered by paying critical attention to situational and contextual character (Hanson & Yosifon, 2003). The specific methods and data collection tools will be illuminated in subsequent sections.

4.2.5.2 Design Science Research (DSR2): Personae

This phase involves use of personae. A *personae* is described as one or several fictitious characters that can represent the majority of potential users of a system with conventional user demands (van Os & van Beurden, 2014). Clarke (1994) conceptualizes a personae as a model of the individual established through the collection, storage and analysis of data about that person and is a useful and necessary concept for developing an understanding of the behaviour of the new, networked world. I argue that through personae, the researcher can understand relationships and how mechanisms in a complex context relate to one another. For example, a citizen can relate to an e-government service sought, citizen requests can result in government service satisfaction or dissatisfaction, which thus leads to observable behaviour. Personae offer a detailed profile of the motivations and tasks of a typical representative of each key user group especially when all users cannot participate in the design (Maguire, 2001; Copper, 2004). They are further used to develop an approach for the profiling of customers based on their perspectives to develop information structure and track their activities (Kim, Iijima & Ho, 2007).

Personae trigger the design team's thinking in an interactive design environment, which further stimulates the co-designer's perception of their prior experience about real users (Lester *et al.*, 1997). For this study, they are constructed from text scripts, models, pictures and cartoons for in-house practice purposes.

In this study, the design team members were asked by the lead researcher to perform highly abstract thought experiments that explored probable mechanisms that could underlie observed patterns. Some of the personae were designed based on real initial data collected from multiple individuals from multiple-use contexts (like health, SME-carpentry, retail shops, supermarkets, drug shops). These were refined from role-plays performed to depict user efforts and experiences. These role-plays did not aim to provide an accurate representation of empirical application, but efforts were made to mimic a user profile. Co-design team members empathised user's needs, experiences, behaviours and goals. These were later aligned during the citizen's actual requirements gathering process.

Using a narrative, picture, and name, a persona provides product designers with a vivid representation of the design target (Miaskiewicz & Kozar, 2011). Personae help to focus decisions surrounding site components by adding a layer of real-world consideration to the conversation. They also offer a quick and inexpensive way to test and prioritize those features throughout the development process. During this phase of the research, designers were encouraged to develop the appropriate descriptions of each personae background, motivations, profiles and expectations. The personae were created from text, graphics, role play personae and pictures so as to leave less to the imagination and create a better common understanding of the target users. Some of the scholars who have used personae for design and teaching design include Jones, Floyd and Twidale (2008); and van Os and van Beurden (2014).

4.2.5.3 Design Science Research (DSR3): User Scenarios

DSR3 was conducted concurrently with DSR2. I utilized user scenarios, usage scenarios or use cases aimed at describing a specific system user-interaction. User scenarios are used to model roles user roles, or role modelling (Börjeson *et al.*, 2006). A role is an abstraction that shows the relation between user groups and their problems. A user role further defines a collection of attributes that characterise certain user populations and their intentional interactions with the

anticipated real system under design (Junior & Filgueiras, 2005). These visualisations of user-product-interactions are continuously incorporated in the application (re)design. The main user scenarios serve to assess the actual user needs or desires, to present and situate solutions, to illustrate alternative solutions and identify potential problems (Bodker, 1999; Sanders, 2003; Garrett, 2010).

User scenarios can be graphic, complemented with explaining text, very much like cartoons and Unified Modelling Languages. Use of such user scenario models can allow exploration and discussion of contexts, needs and requirements (Preece, Rogers & Sharp, 2015). With this cartoon-like use of scenarios, all members in the design team (design assistants, research assistants and users) are able to get the same impression about the interaction. The visualisation of a scenario depends on the available time and resources: some were drawn on paper and manilas using markers. However, three key questions as posed by Börjeson *et al.* (2005) form the methodological focus during the actual design process when using scenarios:

- Predictive scenarios respond to question, “What will happen?” They include forecasts and what-if scenarios.
- Explorative scenarios ask “What can happen?” They explore what can happen in the future, regardless of beliefs of what is likely to happen or opinions of what is desirable.
- Normative scenarios, that ask “How can a specific citizen target be reached?” The focus is at the target groups, their demographic characteristics, what they do and where they live (Börjeson *et al.*, 2005: 5).

The use of scenarios helped stratify and understand the design world from various perspectives as well as prepare tools for effective implementation of design. The scenarios further revealed what could be objectively good and viable prior to undertaking application design. User scenarios are another way of bridging the gap between the design team members and intended application users who may be universally brought into the design space (Börjeson *et al.*, 2005; Hodgkinson & Rousseau, 2009).

A combination of personae and scenarios resulted in four different types of personae:

- i) Goal-directed personae: Focused on what a typical user citizen would want to do with the e-government application service being designed. This was mainly achieved through role-plays where the design team defined who the story is about with fleshed-out

main characters. The scenario defined where, when and how the story of the persona occurred. It described how the persona behaved as a sequence of events. The goal defined what the persona was to achieve or needed to fulfil. When the goal is reached (e.g. process of reporting a crime and response taken), the scenario ends.

- ii) Role-based personae: This focused on the role of the marginalised citizen within the context of e-government application usage. These were based on the qualitative and quantitative data collected during the problem discovery phase and status quo assessment among citizens and their prior use of ICT-based tools.
- iii) Engaging personae: This was used during the empathetic participatory design process. These were to move design teams away from stereotypes to active involvement in the lives of the personae. These personae involved goal and role-based personae.

4.2.5.4 Design Science Research (DSR4): User Experiencing

This is where the simulated e-government application systems are accessed and used by the citizens. Jeffries *et al.* (1991) note that this is where real user tasks are performed and felt by the system users and design team. For this study, the experience tool is used to communicate the research data, personae and scenarios. This was in three forms: low fidelity using paper prototypes, middle fidelity using role-plays and paper. The results of the mixed-fidelity and high-fidelity prototyping simulations using an open source prototyping tool are presented in the findings chapter. The usability experiencing and evaluation was premised in the context-mechanism-outcome configuration of the realist's evaluation (Pawson & Tilley, 1994). The focus is on developing an explanation of how a particular programme works through changing the reasoning and responses of participants to bring about a set of intended outcomes (Dalkin *et al.*, 2015). I focus on whether the application works, for whom and under what circumstances, thereby designing and refining based on co-designers and user feedback.

4.2.6 Case Study Design and Case Selection

This study adopted a multiple case study approach working within Mukono District in Uganda as the unit case for analysis. Yin (1994) notes that the case study method is appropriate when a researcher wants to address either a descriptive question like “what happened?” or an

explanatory question like “how and why did something happen?” Yin (1994: 283) further comments that, “compared to other methods, the strength of the case study method is its ability to examine in-depth a “case” within its “real-life context”. Case studies are appropriate when a researcher wants to illuminate a particular situation, to get an in-depth and first-hand understanding of it. Gerring (2006) reaffirms that the case study approach is a method of evidence gathering that is natural.

In the software engineering context, the case may be a software development project, which is the most straightforward choice or it may alternatively be an individual, a group of people, a process, a product, a policy, a role in the organization, or an event or technology (Runeson & Höst, 2009). Benbasat *et al.* argue that even though a study appears to be a single-case, embedded unit analysis, it could be considered a multiple-case design, due to the decentralised nature of the study sites (Benbasat, Goldstein & Mead, 1987).

Benbasat *et al.* (1987) suggest that, despite a lack of a standard definition for a case study, there are integral characteristics for the case study approach:

- Phenomenon is examined in a natural (usual) setting;
- Data are collected using multiple techniques;
- One or few entities (person, situation, group, or organization) are examined;
- The complexity of the unit is studied intensively;
- Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process, the investigator has a receptive attitude towards exploration;
- No experimental controls or manipulation are involved;
- The investigator may not specify the set of independent and dependent variables in advance;
- The results derived rely heavily on the integrative powers of the investigator;
- The changes in site selection and data collection methods could take place as the investigator develops new hypotheses;
- Case research is useful in the study of ‘why’ and ‘how’ questions because these have operational links to be traced over time rather than with frequency or incidence; and
- The focus is on contemporary events.

It has been argued that realism research concerns selection of multiple cases for replication purposes and is not limited to a single case study. Replication in positivism research refers to repeating a study in various ways, expecting the results to be the same (Hubbard & Armstrong, 1994). In realism research, replication refers to cases where the results are expected to be the same or different. In other words, careful choice of cases should be made such that they either produce (Yin, 1994; Sobh & Perry, 2006):

- similar results for predictable reasons, that is, literal replication; or
- contrary results for predictable reasons, that is, theoretical replication.

This has been termed *contextual replication*, implying that realism involves multiple cases and therefore replication logic as opposed to sampling logic is recommended (Yin 1994; Sobh & Perry, 2006). The relevance rather than representativeness is the criterion for case selection.

This study follows Benbasat *et al.*'s and Yin's notion of embedded case studies where multiple units of analysis are studied within a case (Runeson & Höst, 2009; Thomas, 2011). Moreover, it uses a combination of maximum variation sampling across cases and homogenous sample with cases (Suri, 2011). Maximum variation sampling was constructed by identifying key dimensions of variations and finding cases that vary from each other within the realm of citizens' e-government. It has been observed that in maximum variation sampling, research synthesists can identify essential and variable features of a phenomenon as experienced by diverse stakeholders among varied contexts to facilitate informed global decision-making (Suri, 2011: 5). The cases within a case were homogeneous in that they supported describing a particular sub-group in-depth (Patton, 2002: 275). Figure 18 below depicts the high-level case context:

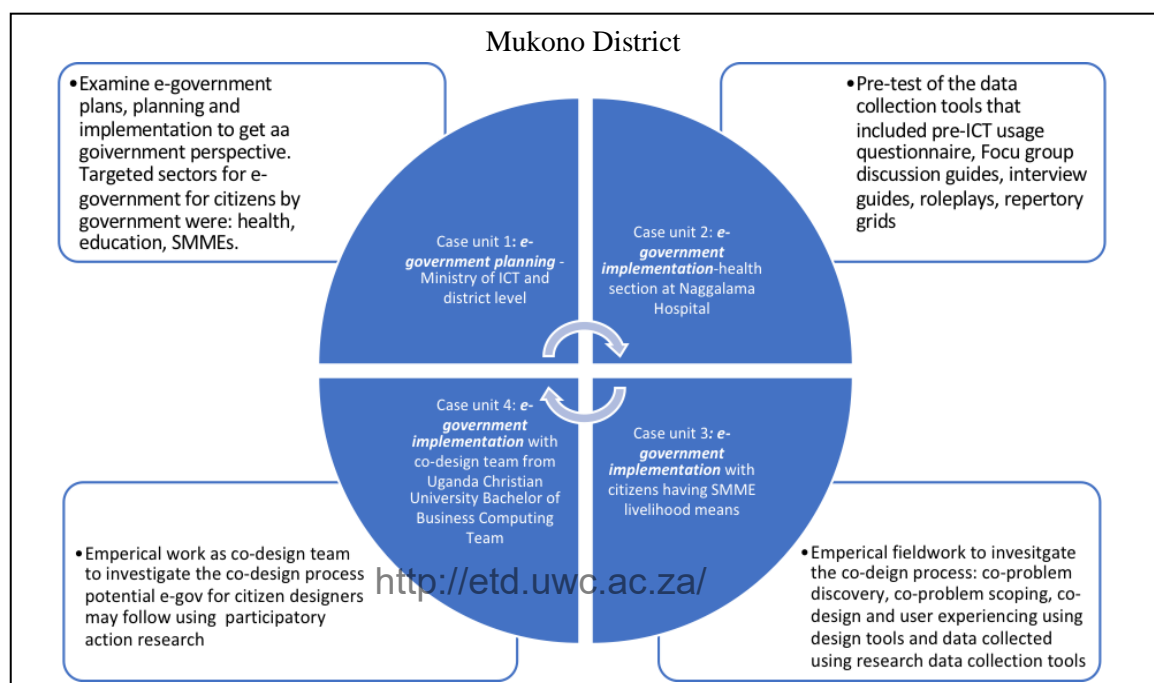


Figure 16: Embedded Units Within a Case Study

The narrative section that follows describes the sampling details for individual participant selection within each unit based on the stratified ontology of e-government under critical realism and the Three Worlds framework. Below is the case stratification of the citizen cohort.



Figure 17: Sampling Framework

From Figure 19, citizen users of e-government applications are the target of the study. Within the realm of e-government exists mechanisms and structures that constrain or support e-government use and adoption at a national level. However, populations are so diverse that mechanisms at that level generate varying events and non-events among the accessible populations (district level). Within the Mukono District are individual citizen categories stratified for purpose of sampling. That is the level at which events are actually perceived (observed and experienced) at an individual and social level.

4.2.6.1 About Mukono District Case Study

According to the Uganda National e-government framework, a data transmission and e-government backbone infrastructure was installed by the government and was completed in 2010 (Ministry of ICT Uganda National e-Government Framework, 2010). The National Data

Transmission Backbone was to span 28 districts while the e-government infrastructure was to connect all government ministries and departments. Under Phase 1, Kampala, Entebbe, Mukono District (the selected case), Jinja and Bombo were connected to the national backbone while 27 ministries were connected to the e-government network.

Mukono District was selected as a case study because it was, according to the National e-government framework, a candidate pilot project for e-government infrastructure development. It is also in close geographical proximity to Kampala where most government ministries are located. Most e-government initiatives are rolled out to Mukono as a pilot district and therefore it was anticipated that issues of access to ICTs would not pose a problem in this study.

The pilot projects included the following: mTrac, a short message service by the Ministry of Health; Mukono Information and Communication Center (MICC) targeting women entrepreneurs to access business information; Uganda Communication Commission through the Rural Communications Technology Development Fund Pilot Project of establishing ICT clubs in secondary schools. Figure 20 locates Mukono District on a map of Uganda.

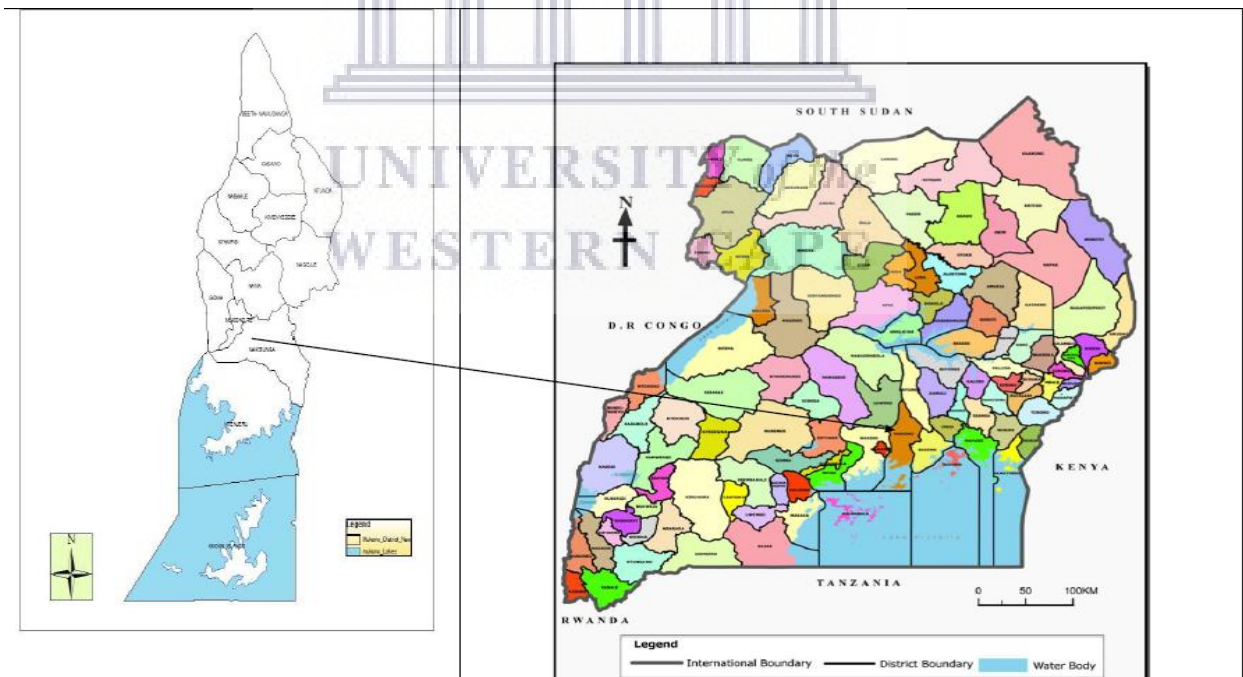


Figure 18: Map of Mukono District (left); Map of Uganda Showing the Location of the Case Study (right) (Source: National Population and Housing Census, 2014)

Mukono District is located in central Uganda. About 88% of the population in the district reside in rural areas. Its citizens largely depend on subsistence agriculture for food and as a source of income, though there are some small and medium enterprises (National Housing Population and Census, 2014 Mukono District Report, 2017). The district is bordered by Lake Victoria. People living on the lake shores engage mainly in fishing activities, others are engaged in farming and SMMEs as their main livelihood means. The district is primarily inhabited by the Baganda people, the largest ethnic group in Uganda, and other small immigrant groups of Basoga, Badama, Bagisu, Basamya, Banyarwanda, Jaluos, Lugbara and Alur. The constituencies are incorporated into the study as follows: Nakifuma, where the rural pilot case study was based; Mukono Municipality, where the researcher and co-design team were located; and Mukono North, Mukono Municipality and Mukono South from which citizens with SMEs as livelihood means were drawn.

4.2.6.2 Case Sampling Overview

Four different case units were investigated, serving to provide multiple views of the complex reality of e-government application for marginalised citizens. Moreover, multiple cases offer cross-case analysis (Marchal *et al.*, 2013) to understand the complex reality of e-government among diversified citizen groups; thereby separating regularities from irregularities. The case study stratified ontology included:

- a) the e-government officer group that formed the key informant group for government's strategy issues (plans and planning). All these groups were located in Mukono District, with the exception of informants from the Capital City of Uganda where government ministries concerned with citizens' e-government are located. This case was coupled with the sampling of case documents, policies and e-government operating procedures;
- b) a rural health hospital – in a rural setting – that formed the pre-test case;
- c) citizens who were owners of an SMME within the Mukono Municipality and neighbouring counties of Mukono District. This formed the user representative and co-design group; and
- d) a cohort of university students which formed the co-design team for design simulation and real fieldwork artefact evaluation data collection.

Table 12 below, presenting the sampled population and associated sampling strategies, provides the detailed selection criteria and rationale for sampling the individual case participants within a case group or unit.

Table 12: Stakeholder Category and Sampling Strategies

Stakeholders and factors	Participant category	Number of participants	Sampling technique
Citizens in the health setting	Pre-test case (Health hospital)	40	Opportunistic sampling Key informant sample
Government staff (service providers) (*RU) Kampala	*MOICT *NITA/*UCC*KCCA	20	Key informant sample and extreme or deviant case, snowball sampling
Typical citizens (service users and co-design team, usability tests).	SME owners as critical citizen cohort	425	Stratified purposive sampling
Typical citizens (service users and co-design team)	User representation groups for usability experiencing (based on co-problem discovery and co-scoping)	25	Stratified purposive sampling, confirming or disconfirming sampling
Co-design team members and research assistants	Co-design team and research assistants	28	Repertory grid sampling method

(Source: Researcher Generated)

- *RU: Republic of Uganda
- *MOICT: Ministry of Information and Communications Technology
- *UCC: Uganda Communications Commission
- *NITA: National Information Technology Authority
- *KCCA: Kampala Capital City Authority

From the sampled populations, the three groups can be summarized in tripartite Figure 21 formed the participatory design stakeholders.

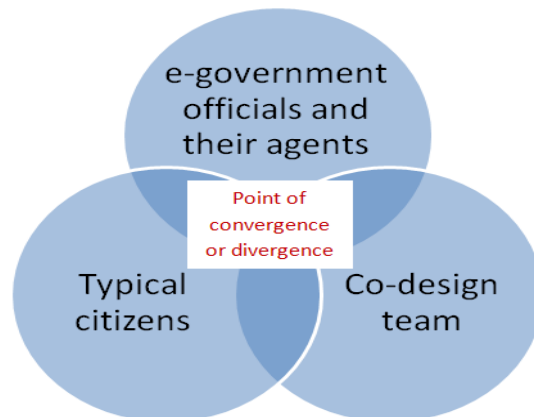


Figure 19: Tripartite Figure Showing the Participant Case Categories for E-Government Participatory Design

It is critical to understand the policy context of e-government from e-government officials, policies and their agents. The design-reality gaps could be assessed at that level. Upon understanding the government context, citizen's lived realities can be assessed prior to design. The designer and researcher undertake that assessment. This results in points of divergence and convergence concerning government officials and their citizens. The following section offers a narrative of case unit descriptions. Detailed empirical methods are provided in the following section.

4.3 Empirical field work methods

Prior to empirical field work, the study was presented to University of the Western Cape Ethical Clearance Committee where the same was sought. In Uganda, the study location, the study was assessed and cleared at three levels: Local Government Level (Kampala Capital Authority that houses all the concerned Ministries), Local Institution Level as a statutory requirement by Gulu University Ethical Clearance Committee and at National clearance level by National Council for Science and Technology (Letters are in Appendix 10, pages 378-383). Below is a summary schedule comprising the main design science research phases (DSR1 to DSR4 phases), data collection methods and tools and sample questions at each phase.

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Table 13: Methods Table Summary and Sample Questions

Design science research phase	Data collection Methods and tools	Sample questions
PHASE ONE: Pre-study phase to establish the status quo regarding e-government applications design methods and modalities.		
<p>Citizens in the health setting to undertake problem discovery and scoping; government officers key informants' interviews; e-government officials in application design</p> <p>(Appendix 5, page 336)</p>	<p>Focus group discussions, think aloud and plenary presentations and brainstorming and problem scoping; key informants' interviews; document checklists; in-depth face-to-face interviews</p>	<p>How can our hospital maintain health service delivery at a low cost while enhancing service accessibility and affordability to the poor population served? What ICT-based solutions can we employ to improve service delivery in our resource constrained environment?</p> <p>What are the available e-government interventions aimed at delivering services and engagement of communities with government?</p> <p>To what extent are you working with the communities to realize your mandate as government, while at same time serving the interests of citizens?</p> <p>What are some of the documented modalities of discovering problems for which solutions are provided to citizens?</p> <p>How do you undertake requirements gathering for design of e-government applications?</p> <p>What is your view of the term citizen-centric design? To what extent is citizen-centric design embraced by the application design team and what is the management commitment towards citizen-centric design?</p>
PHASE TWO: Co-problem discovery and scoping to establish e-government (ICT) utilization perception through a large-scale survey and gather initial requirements for designs		
<p>Problem discovery and scoping (ideation) among SME citizen cohorts aligned to status of e-government policy commitments</p> <p>(Appendix 6a, page 340)</p>	<p>Structured survey with closed-ended questionnaire; then transformative triangulation into in-depth face-to-face requirements gathering</p>	<p>What perceptions (negatives and positives) do participants hold to use of ICTs and e-government applications if any? (Status quo establishment).</p>
<p>Problem discovery and scoping among SME citizen</p>	<p>In-depth face to face interviews</p>	<p>What factors underpin ICT usage among citizens in SME sector in Uganda? How would ICT be used to improve SME sector and citizens in general? What do you envision as benefits of ICTs that would increase your interaction with government? What government services do you access that ICT would</p>

cohorts (ideation)

help you reach out to government and other public servants?

(Appendix 6b, page 340)

PHASE THREE: Co-design artefact development process-for detailed designs that is focused at user persona, scenarios, use cases using prototypes. It includes artefact evaluation criteria and process. It encompassed DSR1-DSR4 processes in-house.

Empathetic participatory design or behavioural simulation using persona and user scenarios with co-design team

(Appendix 7a, 7b page 349)

Paper prototypes and expressive user persona (role-plays) for repertory grid element selection and construct elicitation (low- and middle-fidelity prototypes)

From the four prototypes, choose three random applications from the set (selection).

Identify how two of the three examples are different from the third (triading) application.

Think aloud and uncover constructs important to you based on your assessment.

Name the two polar opposites of the construct, identify which is good and which is bad, then write its two contrasting poles at the opposite ends of a row in the grid.

After identifying and naming the contrasting poles for constructs during the triading step of this process, rate all of the prototypes using their constructs on a scale of 1-7 (7 being the best) (Rating step).

Present your results on a dendrogram or tree diagram and suggest your best and worst applications based on rating scores.

Co-design artefact development process:

Empathetic participatory design or behavioural simulation using persona and user scenarios with co-design youth team

(Appendix 7a, 7b page 349)

High-fidelity prototypes using prototyping tools Justinmind and InvSion with group presentations video recordings and observations; respond to a structured tool for evaluating artefacts

What are the underlying designs constructs, from an empathy perspective, of application interfaces during the design process?

What are the application design constructs that can be categorized into the cognitive criteria of perception, comprehension and projection?

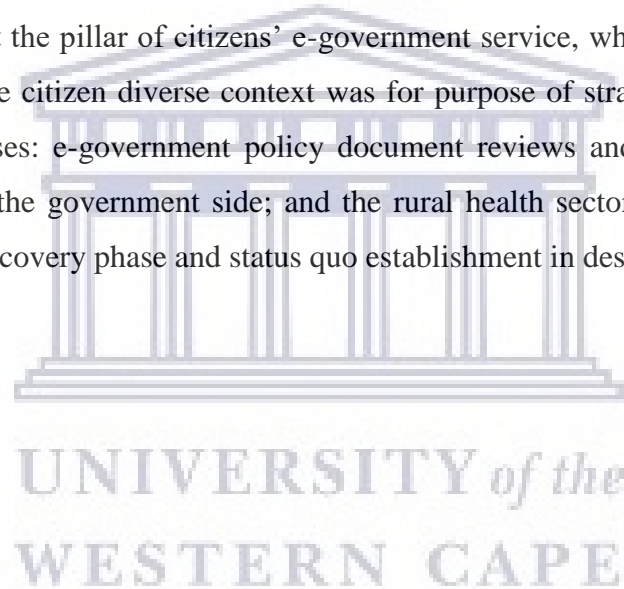
What key lessons can you reflect on from this empathetic participatory design process?

As groups undertake prototype simulation and presentations, co-design teams respond to the artefact evaluation questionnaire.

PHASE FOUR: Citizen usability experiencing through artefact simulations to have a feel and feedback from citizens who generated the needs

Participatory design through artefact simulation and evaluation:	In-depth face to face interviews, demonstrations, user hand on simulation under some instructions of co-design teams' members	What problem does this application seem to solve? To what extent do you agree that it is one on the community's pressing needs? What would you suggest as alternative problems for the community that a similar application would solve?
<i>Fieldwork with real users using simulation</i>		What issues may hinder the communities from using this application once it is finalized and rolled out to citizens?

From Table 13, since e-government being a multi-dimensional problem, the co-design process was premised in such a multi-fasceted nature of the problem. Policy makers are at the pillar of citizens' e-government service, whereas citizens comprise of more than one perspective. However, the selected from the citizen diverse context was for purpose of stratifying them according to the livelihood means. The pilot phase comprises two cases: e-government policy document reviews and e-government officers' implementation context for ascertaining the status quo on the government side; and the rural health sector in which citizens are used in a pre-test phase. This is an initial stage of problem discovery phase and status quo establishment in design science research one.



4.3.1 e-Government Policy Officials and e-Government Policy Documents

Whereas this case was part of the main study, it formed a high level synthesis regarding e-government policy commitments at the pilot phase. During the pilot phase, one of the cases selected was e-government officials and e-government policy documents. The staff, together with ten selected policy e-government documents, were sampled on the basis of manifestations of e-government plans. These included outstanding successful citizen e-government projects if any, notable failures, crises, unusual cases problematic and good e-government scenarios. The same criteria were used to sample government websites for review and for data triangulation and verification purposes as will be discussed later in this chapter. For selection of information, snowball sampling was also used.

Snowball sampling, also called chain referral sampling (Biernacki & Waldorf, 1981; Berg, 2004), involves referrals among people and situations that share or possess similar characteristics of research interest. Snowball sampling and associated purposive sampling strategies, like other extreme deviant sampling, include key informants recommended to offer solutions to understanding complex realities and mechanisms operating within such complexities (Emmel, 2013). Table 14 below provides respondent categories for this specific case:

Table 14: Respondents Category for Interviews and Focus Group Data

Respondent category	Number (N)	Gender	Sampling rationale
Government officers (Interviews)			
Rural Communications Development Fund (RCDF) Manager	1	Male	Key informant in charge of rural technology
Ministry of ICT (Permanent Secretary and Personal Assistant to the Minister of ICT)	2	Male	Key informants in charge national ICT policy
Business Process Specialist MoICT	1	Female	
Software Developer MoICT	1	Male	Key informant FGD for district ICT development
Database Administrator MoICT	1	Male	
ICT specialist MoICT	1	Male	
Programmer MoICT	1	Male	
Other district level officers	7	Males	Key informants
Other district level officers	5	Females	Key informants
Total	20		

The government official respondents included staff from rural communications development fund project, office of the permanent secretary staff, business process department, software

developers, database administrators, ICT specialists, and programmers from the Uganda Ministry of ICT.

At the onset of the study, face-to-face interviews with e-government planners and implementers from the Ministry of ICT and at District Level were undergone. These interviews were used to contextualise the existing e-government policy review that had highlighted e-government national strategic direction, as well as to examine the status quo in government in respect of their stance on citizen-centric design. To select the government officers, the researcher consulted Trembay's ideal characteristics (Marshall, 1996), examining:

- a) *role in the community*: Their formal role should expose them to the kind of information being sought by the researcher. In this case, information sought was about e-government for citizen planning and implementation;
- b) *knowledge*: The informant should have absorbed this information meaningfully;
- c) *willingness*: The informant should be willing to communicate their knowledge and to cooperate as fully as possible;
- d) *communicability*: The informant should be able to communicate their knowledge intelligibly; and
- e) *impartiality*: The informant must be objective and not biased. The researcher paid attention to any biases during the dialogue.

Some of the interview questions were as follows:

1. To what extent are you involved in national strategy and government agents' design of e-government applications?
2. What are the strengths, weaknesses, opportunities and threats of the available e-government interventions?
3. What explains the success and failure of planned e-government applications for citizens?

The informants provided guidance regarding e-government policy documents to support their responses. Documents were selected, accounting for their relevance to the research question, including the following: Budget call framework papers, e-government policy, e-government toolkit, ICT sector annual monitoring reports, Ministry of ICT policy statements, and the national e-strategy. A comprehensive list of documents is provided in Appendix 12, page 386.

4.3.2 Case Unit Two: Rural Health Hospital

The health sector is one of the top-targeted citizen sectors by the Ugandan government (National Electronic Government, Uganda, 2010: 24). This study seeks to examine the status quo about citizens and government commitments towards improving the health sector through the deployment of ICTs. This unit of analysis formed a pre-test of the requirements gathering phase through focus group discussion and interview tools developed. The sampling strategy was opportunistic sampling. Opportunistic sampling allows the researcher access to other sites (Patton, 1990). Some scholars have termed it emergent sampling in the sense that other issues or problems may arise that were not originally anticipated by the researcher (Patton, 2002). This may cause change of action and sampling of other cases. Opportunistic sampling is recommended for studies at their exploratory phase and participatory synthesis (Suri, 2011; Elmusharaf, 2012). This study's sample size was comprised of 40 citizens. These citizens were purposefully selected because of their position and influence in their communities. They occupy positions of information-seeking from the citizens and they are deemed agents of change for community-led interventions.

The citizens included representatives from the religious sector, motor cyclists, village health teams, community elders and community group representatives. This phase resulted in the refinement and revision of pre-usage ICT structured questionnaires, focus group discussion guides and interview guides. Table 15 shows the sample of the respondents (**a** and **b**) at the pilot phase of study:

Table 15: Respondents Category for Interviews and Focus Group Data

Respondent category	Number (N)	Gender	Sampling rationale
Health setting stakeholders (FGD)			
Hospital Board Members	5	2 Males & 3 Females	Key informants
Hospital staff (Nurses and doctors)	5	3 Males & 2 Females	Key informants
Village Health Teams members	20	10 Males & 10 Females	Key informants
Clergy and religious people	5	2 Males & 3 Female	Key informants
Motor cyclists stage managers	5	Males	Key informants

(Source: Field data)

The rationale for the selection of government officers in table 13 was that they are at the core of design and implementation of citizen applications, while the health sector stakeholders in table 15 were selected based on their involvement in community project leadership, mobilisation, awareness and community project implementations.

A focus group discussion formed the foundation of data collection during this research pilot phase. A form of interviewing was used to generate interpretations of the informants and to analyse the social contexts, constraints and resources within which the respondents live (Lunt & Livingstone, 1996; Reed *et al.*, 2009). They entail a non-relativist conception of these social relations and structures, and thus an evaluation of the adequacy of competing accounts of social reality (Smith & Elger, 2014).

The focus group discussions helped examine how co-problem discovery and scoping for design of e-government applications for marginalised citizens occurs. Apart from generating initial requirements, this phase resulted in design of a pre-system usability survey tool for assessing perception of novices towards ICT as a starting point. From a health perspective, citizens were invited to represent various stakeholder groups in order to understand the lived experiences of the health service users from multiple viewpoints. They were community leaders who had an in-depth understanding of the problems in society. They included clergy, taxi drivers, motorcyclists locally known as *boda bodas*, family protection representatives and patient representatives, totalling forty (40) participants.

The leading question for the problem discovery was: How can a hospital in a resource-constrained environment maintain health service delivery at a low cost while enhancing service accessibility and affordability to the poor population served? The purpose of this question was to allow stakeholders to reveal innovative ways of ensuring health service viability using modern technologies as advised by Uganda Ministry of ICT geared at sectoral improvements.

4.3.3 Case Unit Three: Citizens in an SME context

This citizen cohort was the main unit of analysis for the study in design science research one and two (co-problem discovery and scoping). ICT use has a logistical constraint of cost and in Uganda, internet access and use is not free. Average citizens must have a source of income to subscribe to a daily internet bundle. Furthermore, this citizen group was a homogenous group –

easier to sample, and they would serve as a useful proxy of the average citizen (not for generalization purposes, but to help to anticipate and explain the link between the individual citizen within this group and a wider macro citizen context).

Whereas the name and stratification of the unit was SMME, key interest and focus was the individuals within the enterprises as citizens. This is because small changes in the individual mechanisms can have considerable consequences for aggregate social outcomes that a group of individuals is likely to generate (Hedström, 2008). Using stratified purposive sampling for collection of survey data to establish the current realities of citizens in regard to ICTs and e-government use, a sample of n=425 was selected from Mukono District SMME owners and managers (various distributions are provided in the table below). This was to clarify the status quo so that the role of co-design could be properly investigated. Stratified purposive sampling is a non-probability and non-random technique that helps to illustrate characteristics of particular subgroups of interest and facilitate comparisons (Easton, 2010; Emmel, 2013). The technique is a kind of “statistically non-representative stratified sampling” because, while it is similar to its quantitative counterpart, it must not be regarded as a sampling strategy that allows statistical generalization to the large population (Elmusharaf, 2012).

Stratified purposive sampling like other purposive sampling methods involves two major goals that are in line with my study’s choice for the same sampling strategy:

- Sampling to find instances that are representative or typical of a particular type of case on a dimension (s) of interest.
- Sampling to achieve comparability across different types of cases on a dimension of interest (Teddlie & Yu, 2007).

The above sample yielded quantitative pre-usage status quo data. This data was used to strengthen the analytical causal inference of the mechanisms in favour or against available e-government use. Case study research should ideally be performed through a two-stage case study with the use of both qualitative and quantitative data collected from multiple sources, and predominantly qualitative analysis procedures applied in a sequential design (Wahyuni, 2012). Sayer (2000) observes that a critical realist case researcher undertakes both extensive and intensive research. The former employs large-scale surveys, formal questionnaires and statistical

analyses, looks for regularities, patterns and similarities, accepts given taxonomic categories, privileges replication and has restricted ability to generalise to other populations and limited explanatory power (Easton, 2009). The latter focuses on individual agents in context using interviews, ethnography and qualitative analysis, and asks the question “what produces change?”. It employs causal groups, produces causal explanations that are limited to the situation studied so that testing is by corroboration (idem). Moreover, anticipating and explaining the link between the individual and the social context is too complex for a researcher to handle without formal analytical and statistical tools when analysing the link between the micro and macro (Hedström, 2008). Such data was discerned among respondents within a case unit category to establish differences and account for underlying mechanisms of differentiations through abductive and retroductive reasoning. The non-random quantitative survey for establishment of status quo of citizens owning and managing SMEs realized a sample of 425 selected from a district register. The count distributions of the business stratum as units and the case participants are in the Table 16 below:

Table 16: Survey Citizen Owners and Managers of SMEs

Type of Business (SME)		
Case unit (Grouping type)	Frequency	Percent
Medical Centres	45	10.6
Take Away Food joints	15	3.5
Drug shops	40	9.4
Carpentry	30	7.1
Retail Shops	65	15.3
Restaurant	35	8.2
School and pre-schools	60	14.1
Pharmacy	15	3.5
Supermarket	35	8.2
Vet shop	20	4.7
Welding	65	15.3
Total	425	100.0

The above non-generalisable sample yielded quantitative pre-usage status quo data. The researcher designed a pre-system usability closed-ended questionnaire to establish the status quo of the citizens regarding e-government use. This was designed from constructs adapted from consumer behaviour theories like expectation-disconfirmation theory (Oliver, 1980) and other technology adoption auxiliary theories and findings from other studies. The tool was a 5-point Likert scale (strongly disagree to strongly agree). The tool aimed at measuring the pre-ICT usage beliefs and attitudes of the intended e-government users prior to application design. Due to the instrumental role of ICTs in enhancing people's human capabilities in multiple areas, it is important to base analysis of the potential impact of ICTs on the expectations of its actual and realised uses (Gigler, 2004). The tools, examining how pre-usage beliefs and attitudes could influence ICT use intentions so that such beliefs could be disconfirmed during the participatory design process, are included in Appendix 4, page 331.

From each citizen group, five (5) respondents were selected for interview in order to have an early requirement gathering as far as e-government design was concerned. We used a transformative triangulation approach to generate qualitative views pertaining to the potential needs and requirements for detailed scoping and design. The interviews were administered among 65 participants. The purpose of the interviews was to identify underlying beliefs and attitudes and to generate community based representative needs and the lived realities during a problem discovery phase. Below are the summarized results generated from the respondents.

Across all cross-cutting design problems, the analysed data from interviews revealed the following issues for citizens and their fellow community groups:

- An application intended for use by a kidnap victim to send a signal to the authorities or government security agencies like the police for emergency response. This was a common problem among SMEs as criminals believe employees carry money home from work. This was identified as a key intervention area (FindMe e-government application).
- A fire-reporting application within school and institution dormitories to offer real-time response from government agencies. Fire is a big challenge among schools, dormitories and businesses (QuickApp citizen e-government application).

- A neighbourhood home or business (SME) application which monitors for any crime, theft or similar negative incidence to communities for public safety (ReportIt citizen e-government application).
- Some respondents from SMEs reported that they were located far from city centres and yet buses traverse the city where they conduct business transactions. A bus or transport booking system using mobile money as a payment method was proposed to the design team. This is an application for booking a bus for public transport in a constrained environment where transport is not easily accessible (UBus/PublicBus citizen e-government application).

4.3.4 Case Unit Four: Co-Design Team for Empathetic Participatory Design

This is the longest participatory phase out of all the design science research phases (DSR1-DSR4). Participatory design can democratise the design environment and enable close contact between designers and participants that may foster empathy in design (Frauenberger, 2015; Lazar *et al.*, 2017). In this case, co-design team members bring forth their tacit and explicit design knowledge to enrich the design process and outcome before and during the typical user experiencing design phase. I refer to this approach of design as ‘empathetic participatory design’ as adopted and modified from Lindsay *et al.* (2012), Kouprie and Visser (2009), and Hawley (2007) and Sanders (2003) who termed this ‘empathetic user experience design’. It is considered empathetic because it highlights the importance of the design team living through common experiences or facing the same challenges related to usability that users might face.

The empathetic participatory design comprised of 28 second-year Bachelor of Business Computing students from Uganda. Sampling was by census, as all students undertaking the course were co-design participants. Participatory designer teams can be assembled from a group of community-dwelling adult citizens and/or students in university research labs (Ellis & Kurniawan, 2000). This study sought to co-design with students in a university setting. Druin (2010) describes four possible roles of students during the participatory design process:

- as a user (who can be observed or assessed);
- as a tester (who is also asked for comments);
- as an informant (who offers feedback and input); and
- as a design partner (considered equal stakeholder in the design process).

When working with students as design partners, mature adult designers with highly formalised knowledge and experiential tacit knowledge should be gatekeepers to the design processes (Bovill & Bulley, 2011; Bovill, Bulley & Morss, 2011).

4.4 Data collection methods

In participatory design, the researchers and co-designers double their roles as participants to simulate the lived experiences of the researched and during the process data is generated as the teams try to understand the design context. Co-design team members bring forth their own tacit and explicit design knowledge to enrich the design process and outcome before and during the typical user experiencing design phase. This study includes the participatory component as the simulated artefacts were taken before the potential users on several iterations (some informal and formal iterations) to further generate user views based on their hands-on usage. Some other scholars have referred to such empathetic behavioural simulation (Hensen & Lamberts, 2012).

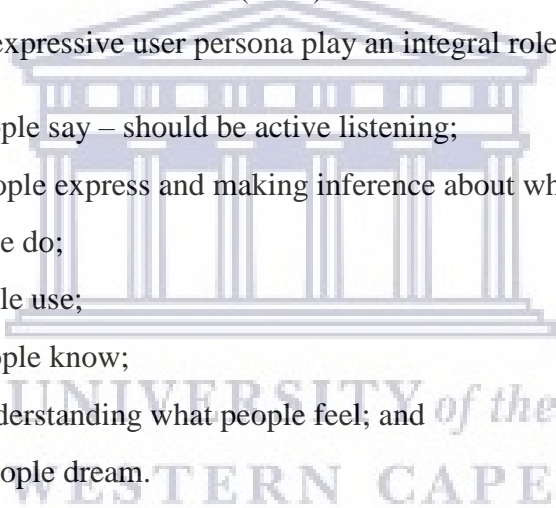
During empathetic participatory design, multi-methodological data collection methods were used to collate data. These included quantitative surveys, role-play and repertory grids. It forms the greatest substantial part of the design process. A closed-ended questionnaire was implemented in-house among the co-design team members during the empathetic participatory design phase. The process of design involved collection of data using repertory grid techniques, in-depth interviews, role-play and paper prototypes and closed-ended cognitive questionnaire artefact evaluation of the high-fidelity prototypes developed using Justinmind prototyper. There was interplay between the in-house empathetic participatory design and user experiencing among the user groups. Transformational triangulation was used to collect data so that a thorough user behavioural simulation could occur prior to testing the prototypes among users. The three major empirical methods for data collection were expressive user persona, repertory grids and quantitative closed-ended structured questionnaire for artefact evaluation.

4.4.1 Application of Expressive User Persona for Construct Elicitation

During the paper prototyping low-fidelity phase, the researcher used role-play, herein referred to as 'expressive user persona' to corroborate their constructs as observed from the co-design team

members. Expressive user persona was combined with repertory grids to evaluate prototypes as elements with constructs (Appendix 13, page 387). The following studies employed role-play during initial element generation and construct elicitation: Svanaes and Seland (2004); Simsarian (2003); Laurel (2003); and Arvola and Artman (2006). The role-play blended with interviews offered opportunity for participants who were not in a position to identify elements from their own experiences. During role-play, focus group discussions were conducted among co-design team members for reflective discussions about the observed scenarios and the identification of user persona. After expressive user persona, focus group discussions were used to elicit user needs for feedback on concept sketches or prototypes or to let participants generate new ideas (Axelsson & Melin, 2007).

Sanders (2002) and Iacucci, Kuutti and Ranta (2000) offer the following questions for accessing user experiences for which expressive user persona play an integral role:

- 
- listening to what people say – should be active listening;
 - interpreting what people express and making inference about what they think;
 - watching what people do;
 - observing what people use;
 - uncovering what people know;
 - reaching towards understanding what people feel; and
 - appreciating what people dream.

Oulasvirta, Kurvinen and Kankainen (2003) in their paper *Understanding Contexts by Being There Through Body Storming*, note that role-play is critical in studies where there is an interplay of research, documentation and design. Müller and Thoring (2012) conducted a structured literature review and highlight the use of role-play, as in Table 17 below.

Table 17: Expressive User Personae

Source	Used Term	Participants	Place	Props	Research Field
Oulasvirta, Kurvinen et al. (2003)	Bodystorming	Designer	Field	Low-fidelity prototypes	Ubiquitous Computing
Buchenau and Suri (2000)	Experience Prototypes	User	Laboratory	Low-fidelity prototypes	Design
Svanaes and Seland (2004)	Role-Play	User and Designer	Laboratory	Various	HCI
Dishman (2003)	Informance	Researcher	Laboratory	Foam walls, Low and high-fidelity prototypes	Design
Mehto, Kantola et al. (2006)	Drama	Researcher	Laboratory	Various	HCI
(Cantoni, Botturi, et al., 2009; Cantoni, Marchiori, et al., 2009)	LEGO Serious Play	User and Designer	Laboratory	LEGO bricks	HCI
Simsarian (2003)	Role-Play, Bodystorming, Informance	Designer	Laboratory	Low-fidelity prototypes	Design
Laurel (2003)	Interactive Drama	Designer	Laboratory	Various	HCI
Arvola and Artman (2006)	Interaction walkthroughs, Improvised role play	Designer	Laboratory	Various	HCI

(Source: Müller & Thoring, 2012)

‘Expressive user personae’ fits perfectly into a critical realist’s ontological view of a stratified world – it can reveal both the observable and unobservable in the three domains (real, actual and empirical). The other methods (focus group discussions and interviews) were employed to validate the results generated from the designed applications.

4.4.2 Repertory Grid Methods and Repertory Grid Sheets

The application of a repertory grid (RepGrid) involves a number of participants who are knowledgeable about the topic being explored (Alexander *et al.*, 2010). It involves agreement on a topic and the identification or provision of a series of elements (Kelly, 1955). The first empathetic design step in this study was by use of low-fidelity paper prototypes to design applications for the problems identified during the in-depth interview process from which data was collected. In this study, elements comprised applications that were being prototyped. In addition, interviews were utilised, allowing for a systematic comparison of the elements. This resulted in respondents identifying “constructs”. Constructs are expressions of intuitions, "gut feelings", and perceptions, comprehension and projections which the individual uses as a guide to action, without necessarily having verbalised them explicitly prior to the interview (Mezirow, 1993; Endsley, 1997; Nehme *et al.*, 2006; Björklund, 2008). They investigate attitudes and

beliefs, concepts, assumptions, self-insight or reflection, understanding and cognition (Hunter & Beck, 2000).

When using the RepGrid technique, a large sample is not required to reach the required level of redundancy and 15 to 25 participants can be sufficient (Tan and Hunter, 2002). The same principle formed the basis for selection of co-design participants. Based on the repertory grid technique (Bell & Nusir, 2017), the approach involved five steps: introduction, element selection, construct elicitation, the rating of elicited constructs and review as per Figure 22 below:

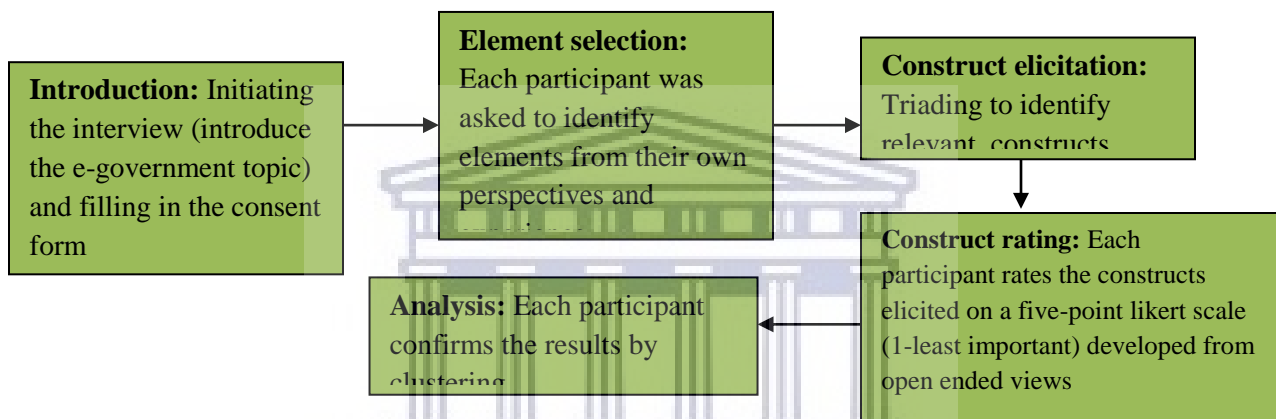


Figure 20: Repertory Grid Interview Process

4.4.2.1 Introduction: Initiating the Empathetic Interview Process

To ensure that the design and research team understood the underlying concepts in RepGrid, the facilitator used well-known mobile applications. The co-design team members generated their favourite list of applications as elements and their descriptors as constructs. In four (4) groups each having a minimum of five (5) co-design members, they identified at least five constructs that describe the elements (applications). At that point, the researcher accommodated bias as the team members generated constructs based on their perception. The aim was to examine knowledge awareness pertaining to elements, constructs and scaling or rating the elements, as well as ranking. The elements (prototyping applications) were as follows: QuickApp, ReportIt App, FindMe App and UBus App (all of which are citizen-centric related online reporting

applications for fire, accidents, kidnapping and transport-booking in a rural setting respectively). Below is an example of UBus App paper prototype in Figure 23:



Figure 21: Sample Paper Prototype (UBus)

4.4.2.2 Element Selection

During each session, the team members were requested to draw up the grid using the initial prototype set. Each person worked independently with the selected set of prototypes. Whereas Hunter and Beck (2000) suggest that six elements provide sufficient variability in the subsequent elicitation process, Bell and Nusir (2017) worked with seven elements and for this study, the researcher used the minimum four that were available. The element pool helps identify constructs from which other elements are later rated (Curtis *et al.*, 2008). The constructs can be a role list that comprises of short sentences or phrases (one for each element) that describe typical elements in a domain (Curtis *et al.*, 2008). After element selection, the next step in the repertory grid technique is triading.

4.4.2.3 Construct Elicitation (Triading)

This is the core aspect of eliciting constructs without introducing bias from the lead researcher (Daniels, De Chernatony & Johnson, 1995; Van Loggem, 2015). The selection of the three elements is random so as to give each element an equal chance of selection and avoid bias (Van Loggem, 2015). Design team members were asked to identify how two of the three examples are different from the third. No starting point is provided and team members are asked about the constructs that are important to them. The constructs generated by each co-designer are not related to that of the principle investigator. This phase is critical as it uncovers the knowledge bases as constructs important to each team member. Once the member identified a construct, or noted how two prototypes were different from the third, they were asked to name the two polar

opposites of the construct, and write the poles at the opposite ends of a row in the grid, shown in Table 18 below:

Table 18: Repertory Grid Template

Elements	QuickApp	APB App	UBus App	FindMe App	
Constructs here	Rating	Rating	Rating	Rating	Opposites of the constructs
(Bi-polar)	Rating	Rating	Rating	Rating	(Bipolar)
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	

Rating scale 1-7 (1-least rated and 7-Most rated)

The team members continued triading the prototypes to identify additional constructs. They were encouraged to identify which two examples were alike and which were different for the different constructs. This was to elicit as many constructs as possible without suggestion from the lead researcher, who simply encouraged interaction among team members to share knowledge and shape their naming. Every co-design team member would seek consultations from the researcher for prompts regarding naming elements and refining constructs. Sharing knowledge at this point resulted in better refinement and led to consonance, convergence and expectation-confirmation state. To ensure that co-designers were actively engaged, the researcher asked probing questions that encouraged them to think aloud, avoiding hints for constructs to minimize bias. The next step was construct rating while laddering.

4.4.2.4 Construct Rating and Laddering

Each member was asked to rate the constructs elicited on a seven-point Likert scale (1 representing least important and 7 the most important). Kelly (1955) used a 2-point rating scale and Adams-Webber (1981) followed suit, but there are now longer scales like the one of seven (7) used in this study. Laddering, a technique within the RepGrid, was used to generate detailed explanatory arguments in reference to the elicited constructs (Fransella, Bell & Bannister, 2002). Laddering is a form of abductive and retroductive reasoning where design team members move forth and back to rate the elements onto the constructs. The laddering technique was

corroborated with question prompts presenting team members with the opportunity to think aloud. Laddering further allows team members to articulate the elicited constructs by incorporating a series of “how” questions in addition to the “why” questions (Hunter & Beck, 2000). The final phase is analysis.

4.4.2.5 Analysis of Repertory Grid Method Data

The results of the Repertory Grid were analysed both quantitatively (in numbers) and qualitatively using the Atlas Ti qualitative data analysis programme. Notes and descriptors of the constructs from the members’ own knowledge bases from triading were assessed to examine their understanding, knowledge and language. The co-design team members, through participatory action learning, developed a ‘factor tree analysis’ (sample presented in Figure 24) or ‘dendrograms’ to cluster elements, their constructs and ratings. This resulted in the ranking of the prototypes.

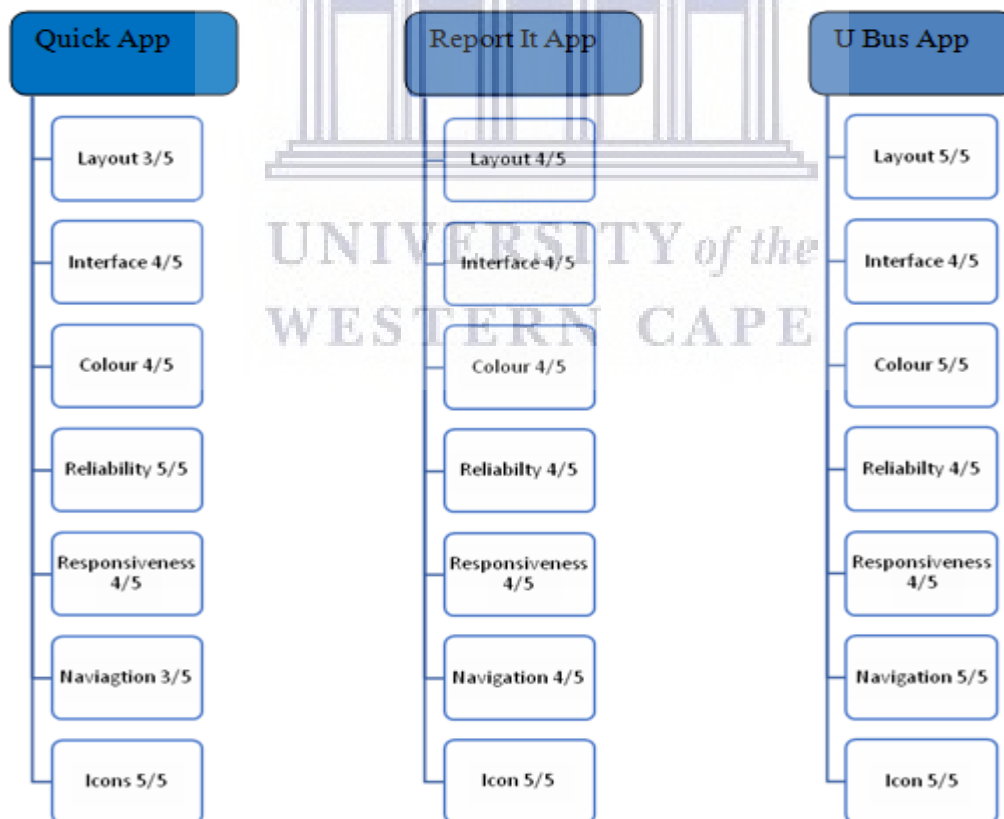


Figure 22: Sample Factor Tree Analysis

4.5 Combined Use of Expressive User Personae and Repertory Grids

Repertory grids and expressive user persona were used in a reciprocal manner as provided in Figure 25 below:

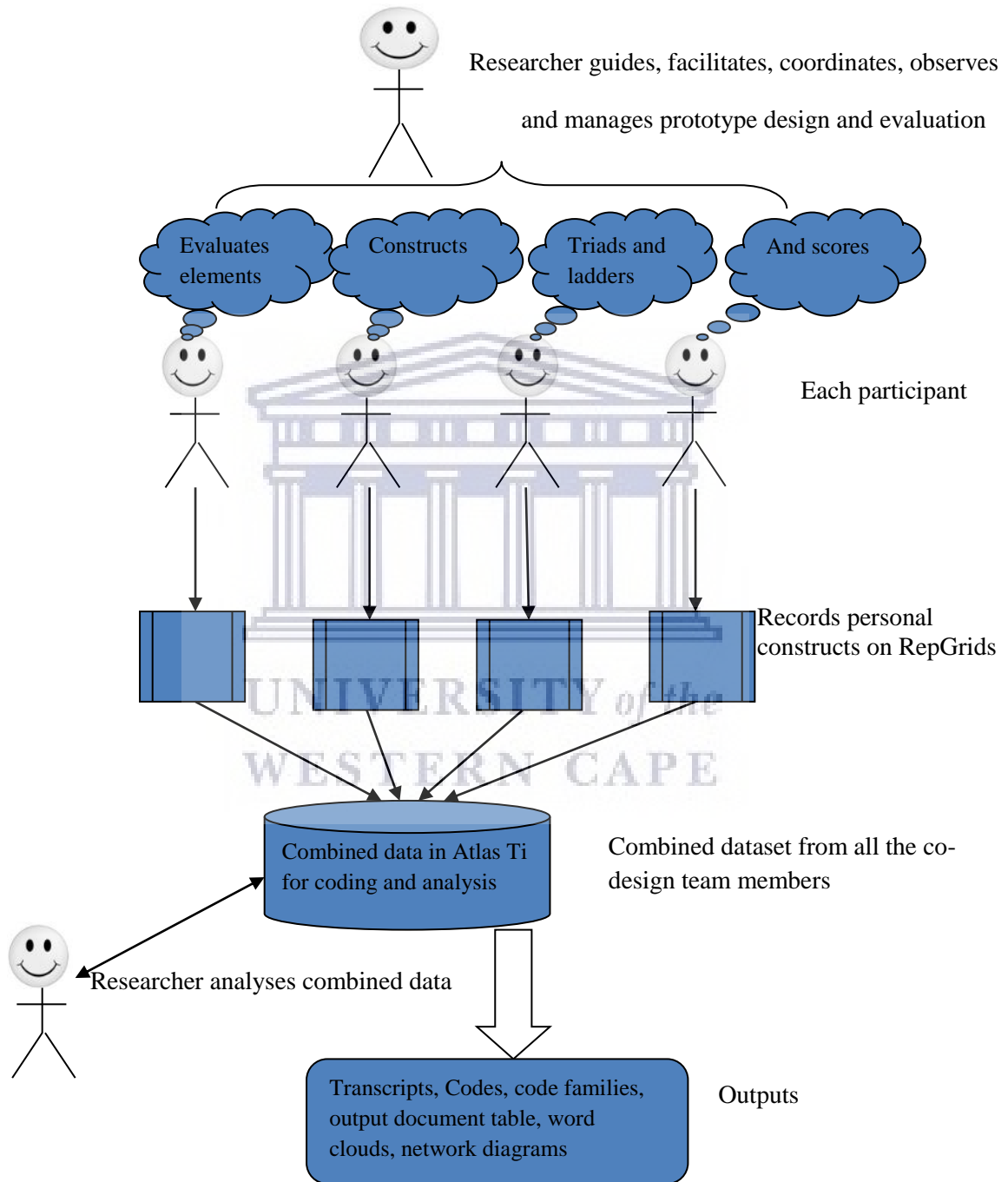


Figure 23: Expressive User Personae Graphical Representation of Paper Prototypes and Repertory Grids

Use of expressive user personae involved the lead researcher and designer facilitating and coordinating the role-plays during use of prototypes and repertory grids. The individual research assistants evaluated the elements, developed their own constructs and contrasted them during the triading process, finally scoring the elements. This process produced individualized repertory grids. The lead researcher generated a dataset into Atlas Ti for detailed coding.

4.6 Cognitive Closed-Ended Questionnaire

Using the Situation Awareness Theory (Endsley, 1995) and Kelly's Personal Constructs Theory, through a critical realist lens, a closed-ended artefact evaluation was designed. It formed the basis for construct naming, and it was further refined using the constructs generated from the repertory grids. The dimensions of the questionnaire were perception, comprehension, projection and participatory action learning. The tool in Appendix 8 page 356 was developed on a scale of 1-5 (strongly disagree to strongly agree respectively) and used to collect quantitative data from the co-design team members during the empathetic participatory design and during usability fieldwork experiencing. The cognitive closed-ended questionnaire was used alongside the in-depth face-to-face interview and observations to generate constructs that lie outside the structured tool. These constructs were later labelled contextual latent variables and tools were checked for validity and reliability.

4.7 Usability Experiencing Phase among Selected Citizens during participatory design with simulation

This was the final phase in design science research four where the designed artefacts were simulated among the selected citizens from whom requirements were sought. The major tools at this phase were observations and in-depth face-to-face interviews. From usability experiencing, the recommendation is to simulate among a maximum of five users. So each co-design group comprised of seven members simulated the artefact among five citizens. The aim was to generate artefact evaluation criteria from users' points of view and corroborate them with the designed cognitive artefact evaluation closed-ended tool with dimensions of perception, comprehension and projection. Other items that fell outside the cognitive tool were labelled 'context-based items'.

4.8 Validity and Reliability of Data Collection Methods

In the quantitative research paradigm, various forms of validity include design validity, measurement (or analytical) validity and inferential validity (Abowitz & Toole, 2009). *Design validity* broadly refers to internal (the correlation observed is causation) and external (results can be generalized) validity; *measurement validity* includes the reliability of the data (i.e. if there is measurement error); *construct validity* describes the degree to which the variables used in the model capture what they intend to measure (Venkatesh, Brown & Bala, 2013). Finally, *inferential validity* refers to the validity of the statistical conclusions and whether or not they are sufficient for drawing inferences (Zachariadis, Scott & Barrett, 2013).

4.8.1 Validity and Reliability Through Abduction and Retroduction

In this study, the purpose of a pre-system usability structured questionnaire was to establish whether the generative mechanisms hypothesized or uncovered were involved in the observed events in the field (Wynn & Williams, 2012). To ensure validity of the survey tools abductive and retroductive reasoning were used for construct and content validity. This theoretical lens offered a conceptual apparatus for the data and themes not fitting that framework were given explanatory power. For instance, Reichertz (2007) perceives abduction and retroduction as “a cognitive logic of discovery” (p. 220). It is a form of inference used especially for dealing with surprising findings in our data. It directs the analyst to make sense of their data and produce explanations that make surprising findings unsurprising. Scientists against abduction and retroduction perceive them as antithetical strategies. They claim they involve letting the researcher’s mind wander without any specific goal in mind, or what Pierce (1931–1935), a key writer on abduction, called “musement”/serendipity (Remenyi, 2018). On the contrary, other authors observe that use of abduction and retroduction ensures that the research perspective and results are grounded in theory as well as in practical settings (Dubois & Gadde, 2002; Reichertz, 2007; Timmermans & Tavory, 2012).

In addition, abduction and retroduction form a cognitive logic discovery and self-emergency situation for dealing with surprising findings (Reichertz, 2007: 221). This implies that in the face of not knowing what to make of a surprising finding, rather than dwelling on the infinite number of possibilities, the analyst employs data and emerging theory for a unified meaning (Wynn &

Williams, 2012:). Abduction and retroduction reveal causal mechanisms and demi-regs and it is a more advanced form of comparative analysis counterfactual approach to causation while at the same time contributing to great rigour and relevance (Paavola, 2004; Tsang, 2014).

4.8.2 Validity and Reliability Using Cronbach's Alpha Coefficient

The pilot phase of this study in case 2, and as adapted in case 3, was a validity and reliability check that resulted in a refinement of the tools. The resultant structured questionnaire that was used to study pre-system usage beliefs and attitudes was developed from theoretical constructs and factor naming was used for exploratory factor analysis. The resultant constructs were benefit expectation, ICT learnability, ICT support, ease of use, user-centeredness and user confidence.

The cognitive artefact evaluation structured questionnaire as generated during the empathetic participatory design from the repertory grid technique (case 3 and case 4) was checked for validity using the Situation Awareness Theory (Endsley, 1995) and for reliability using Cronbach's Alpha Coefficients of reliability establishment (Cronbach, 1972; Jonsson & Allwood, 2003; Pather & Uys, 2008).

4.8.3 Validity and Reliability of Qualitative Data Collection Methods and Tools

Research conducted through a realist lens assumes an ontology where research is dealing with complex social phenomena involving reflective people and dealing with fuzzy boundaries (Bhaskar, 1979; Yin, 1994). Much as there was empathetic participatory design simulation, the aim was to understand the lived experiences of citizens through personae and scenario development in order to understand the complex phenomenon of interest prior to empirical work. There was awareness that research work is neither value-laden nor value-free, rather, researchers are value-aware, implying that a participant's perception of realism is a window to reality through which a picture of reality can be triangulated with other perceptions (Healy & Perry, 2000).

At a methodological level, validity and reliability of research from a qualitative paradigm is attributed to trustworthiness as advanced by Lincoln and Guba (1985). *Trustworthiness* refers to the extent to which the research can be audited by developing a case study database and by the

use of quotations in the written report (Healy & Perry, 2000). This study draws from trustworthiness models developed, as such models have comparatively and conceptually been used by quite a number of information systems researchers like Kaplan and Duchon (1988), Orlikowski and Baroudi (1991) and Myers (1997) among others. The criteria of trustworthiness of research is summarized in Table 19 below.

Table 19: Criteria of Trustworthiness

Criteria	Techniques
Credibility (internal validity)	1) Prolonged engagement 2) Persistent observation 3) Triangulation (sources, methods, context and investigators) 4) Peer debriefing 5) Negative case analysis 6) Referential adequacy 7) Member checks
Transferability or external validity, causal inference	8) Thick description
Dependability (reliability)	9) Overlap methods (triangulation of methods, multi-methods) 10) Dependability audit-examining the process of enquiry (how data was collected, kept and data accuracy)
Confirmability (objectivity); balance between objectivity and subjectivity	11) Confirmability audit-examines the product to attest the findings, interpretations and recommendations supported by data.
All four criteria	12) Reflexive journal (about self and method)

(Source: Edited from Loh, 2013: 5)

Similarly, though not as exact as Loh's criteria, Baskerville, Kaul and Storey (2017) clearly categorize some of the above criteria into a Design Science Reliability Framework comprised of two dimensions: what and when. Their 'what' comprises of environment and methodology, artefact design science research and design knowledge while their 'when' incorporates synchronic (internal) and diachronic (external) criteria (Baskerville, Kaul & Storey, 2017). *The Online Cambridge Dictionary* defines *synchronic* as relating something at a particular point in time without considering how it progressively developed to that point, while diachronic relates to changes in something that happen overtime. Design science research has these two-time related series; design activities at a point in time and design activities where consideration is at the final product. However, while they are categorized on the continuums of when and what, Lincoln and Guba's (1985) criteria in Loh (2013: 5) form the basis for the reliability and validity check for the qualitative component of this study.

These criteria were mapped on to Purao *et al.* (2008) and Hevner's (2007) design science research cycle which incorporates validity and reliability dimensions of context, methodology, artefact and knowledge dimensions. Table 20 summarises validity and reliability based on methodology, artefact and design knowledge criteria, validity and reliability techniques and applicability to this study.



Table 20: Validity and Reliability Summary Table

Methodology, artefact and design knowledge criteria	Techniques	Applicability to this study
Credibility (internal validity)	Prolonged engagement	The research and design activities had several iterations for a period of two years, in multiple locations and cases. Various research and design contexts, and therefore multiple case studies, recommended as key if a robust theory is to be advanced as per Benbasat, Goldstein and Mead (1987). [<i>Environment and Methodology</i>]
	Persistent observation	Ensured there was intensive and rigorous research procedure from problem discovery, problem scoping, artefact development, evaluation and usability experiencing. [<i>Environment and Methodology, artefact design science research and knowledge base</i>]
	Triangulation (sources, methods, investigators)	Use of multiple case studies helped discard methods that seemed inapplicable in given contexts. For instance, whereas the repertory grid technique was not appropriate for the health case study, it worked very well among the co-design team members. Role-plays that did not work among community users worked well during refinement of the prototypes. [<i>Environment and Methodology, artefact design science research</i>]
	Peer debriefing	The design and research team would have reflective discussion on what transpired in the field and during peer group working. Uncooperative team members were probed and encouraged to complete their respective tasks. In case of performance gaps, there were inbuilt training sessions to close the skill gaps as and when identified. Each of the four groups of the design team had a team leader to interrogate any issues faced by the group that would curtail performance. [<i>Environment and Methodology, artefact and knowledge base</i>]
	Negative case analysis	It was crucial to articulate any data that would differ from the team expectations. The purpose was not to discard them but to ensure that convergence was reached during the subsequent field exercises either the research or design team trade off in favour of the user. There were instances when users' requirements were too unrealistic to be incorporated into design. The incremental involvement of the prototype would reveal any impossibility to the user without direct rejects. Additionally, empathetic design was crucial to generating such expectations prior to interfacing with users. I used "what if?" analysis scenarios. [<i>Methodology, artefact and design knowledge</i>]
	Referential adequacy (archiving of data)	This involved identifying portions of data to be archived, but not analysed since the process had a great deal of collected data. For instance, some pre-system usability data could be recalled for reflective purposes about any anticipated usability challenges. The researcher could then conduct the data analysis on the remaining data and develop preliminary findings, analysing it as a way to test the validity of findings. Some secondary data resulted in tool design while interview and repertory

		grid empirical data could be used to corroborate the quantitative tool under development. [Environment and Methodology, design science research and knowledge base]
	Member checks	This was among the co-design team members and with the users as co-designers at the periphery. During the prototyping process, the teams could switch roles to assess the other group's prototypes. Even during the in-house prototype evaluation, when one team was presenting, the other team members were evaluating the prototypes. Out of the four prototypes, each co-design members evaluated three applications excluding his/her own. This allowed for constructive feedback even before undertaking usability testing. The data collected was cross-examined among members of the group to ensure it was accurate before submission. [Methodology, artefact and design knowledge]
Transferability (external validity)	Thick description	This involved describing each case study, providing rationale supported by literature and ensuring that there are contrasting demographics so that data and product generated could be transferred to similar cohorts. Though the problem discovery was from particular cases of a given case study, it was easy and acceptable to test the applications among participants who were not initially at the co-problem discovery process. No user complained that the application was useless or irrelevant to them. This was because we targeted particular demographics within a given context. Web application with online booking and complaint form was for a health-setting while applications like fire was accepted among homes, schools and businesses. [Methodology]
Dependability (reliability)	Transformative triangulation of methods Dependability audit-examining the process of enquiry (how data was collected, how data was kept, accuracy of data)	There was triangulation of methods aimed at collecting data where unspoken usability issues could exist. For example, expressive user persona or role-play through body storming revealed a lot of feelings, emotions and other unspoken messages. This would not be possible with one type of tool like an interview guide or questionnaire. The repertory grids generated many constructs (150+) that were used to valid the quantitative user-experiencing tool. This would not be possible for one researcher using one type of tool like an interview. This is because the technique resulted in multiple perspectives among the co-design team, enriching the design process. [Methodology, artefact and design knowledge]
Confirmability (objectivity)	Confirmability audit-examines the product to attest that the findings, interpretations and recommendations are supported by data.	Methods employed during artefact development yielded results consistent with user expectations. Through multiple case studies, each case was initially handled independently as a single case study and in a longitudinal manner. The research activities involved use of multiple sources of data from diverse data collection methods like surveys, role-plays, in-depth interviews, key informants, repertory grid techniques, multiple tests, workshops or lab tests produced data and empathy design methods. [Methodology, artefact and design knowledge]

4.9 Methodology Triangulation: Putting it All Together

This study involved the following triangulations: context triangulation, data triangulation, method triangulation, theoretical triangulation and design-researcher triangulation. Triangulation assumes a single reality and thus is only appropriate within the realism paradigm and is not appropriate within constructivism or critical theory research – two paradigms that assume that there is not a single objective reality but rather multiple subjectively constructed realities that are incommensurable (Sobh & Perry, 2006). In realism research, triangulation provides a “family of answers” (Pawson & Tilley, 1997) that covers its reality’s several contingent contexts to capture a single, external, and complex reality. For example, different interviewees (citizens) from varied contexts are asked the same question to test whether they answer with the same perceptions. Sometimes, these different sources will provide different perceptions, but those different perceptions should not be considered confusing glimpses of the same reality, but rather foster understanding of the reasons for the complexities of that reality. This further shows why numbers should not be the only data used in realism data analysis and why such data analysis should concentrate on “reasons why” (Sobh & Perry, 2006: 1203).

In this study, the very first point of departure for triangulation was vested in the design science research methodology choice. Unlike the conventional research, this study involved a research through design or research through doing. This resulted in practice-theory triangulation where the design research process was informed by priori theoretical frameworks designed at the onset of the study.

It has been argued that realism research concerns selection of cases from multiple cases for replication purposes not limited to case study research. Replication in positivism research refers to repeating a study in various ways, expecting the results to be the same (Hubbard and Armstrong, 1994). In contrast, in realism research, replication refers to the choice of cases where the results are expected to be the same or different. In other words, careful choice of cases should be made such that they produce either (Yin, 1994; Sobh & Perry, 2006):

- similar results for predictable reasons, that is, literal replication; or
- contrary results for predictable reasons, that is, theoretical replication.

As an example, I could predict that e-government officers would say the same thing during an interview about citizens' use of e-government (literal replication), and that citizens would say something different to them (theoretical replication). This has been termed contextual replication that implies that realism often involves multiple cases, and therefore replication logic as opposed to sampling logic is recommended (Yin 1994; Sobh & Perry, 2006). The relevance rather than representativeness is the criterion for case selection.

At the onset of the study, qualitative data from e-government policymakers and the health sector case study were analysed using Thematic Content Analysis (TCA) whilst combining content and thematic analysis manually. Thematic Content Analysis is conceptualised as a descriptive presentation of qualitative data (Bloor & Wood, 2006). The authors observe that the purpose of content analysis is to describe the characteristics of the document's content by examining who says what, to whom and with what effect. Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data (Braun & Clarke, 2006). This study combined the two analysis methods, given that Vaismoradi *et al.* (2013) and Smith *et al.* (1992) observed that the two share the aim of analytically examining narrative materials from life stories by breaking text into relatively small units. The researcher grouped and distilled from the texts a list of common themes in order to give expression to the communality of perspectives across participants. Every reasonable attempt was made to employ names for themes from the actual words of participants and to group themes in a way that reflects the texts as a whole.

The data from the policy documents, as well as data from e-government policymakers and implementers and focus group data from health sector stakeholders and citizens, was triangulated to assess the design-reality gaps. In other words, this multi-method data was corroborated to examine the policy commitments and how they are aligned or not aligned to the citizens' marginalised perspectives while working in the health setting, which was identified as a candidate sector for e-government design for citizens (Uganda National e-Healthy Policy, 2016).

During the same study phase, in the health setting, the results of the focus group discussion informed a more diverse case context. Moreover, from the citizen owners and managers within the SME context, data was analysed and the tool was assessed for validity and reliability. A number of questions were corrected since most respondents did not have prior knowledge about

e-government. The participants had scant knowledge about prior use of ICTs, but not e-government per se. This informed the redesign of the questionnaire to generate perceptions about their intentions to use ICTs if such an opportunity prevailed. This questionnaire was referred to as a pre-system usability tool for ICTs among citizens. It was used prior to the problem discovery and scoping to examine the perceptions of citizens and any other potential users about ICTs. Both negative and positive perceptions were assessed which were not in the questionnaire used during the pilot phase.

The redesign of the pre-system usability was validated with the available usability tools and theoretical frameworks for construct development viz. expectancy disconfirmation theory (EDT) (Brooke, 1996; Bangor, Kortum & Miller, 2008). The tool was validated using Technology Acceptance Models (TAM), Unified Theory of Acceptance and use of Technology (UTAUT) (Venkatesh, Thong & Xu, 2012) and other TAM extension models.

The criteria were modified based on the argument in previous studies to include both tangible and intangible issues in respect to pre-usage beliefs and attitudes (Remenyi & Sherwood-Smith, 1999; Jones, 2008; Gomez & Pather, 2012). The items in the instrument included a measure of negative and positive ICT pre-usage beliefs and attitudes with a total of 14 items (7 negative and 7 positive pre-usage expectations). For all constructs, I asked respondents to rate their ICT usage expectations or perceptions on assumptions that they were not familiar with computers, using a 1-5 Likert scale (1=strongly disagree, 5=strongly agree). The constructs were not listed in any particular order but were subjected to categorisation using an exploratory factor analysis procedure. The use of pilot studies has been defended under realism research. It has been argued that the development or refinement of theoretical concepts based on small-scale qualitative studies is often combined with statistical techniques such as factor analysis to determine the degree of convergence with quantitative measures of particular phenomena (Modell, 2009).

A One-Way Analysis of Variance (ANOVA) was used to examine differences in pre-usage expectations based on the SME owner citizens' profiles that formed the main unit of analysis during the participatory design process. Use of such statistical methods and inference are

important to understand the process by which something has been generated and knowing relevant mechanisms like pre-usage expectations is necessary for statistical inference (Hedström, 2008). For instance, in the regression model, the coefficient of determination (26%) provided an explanatory power of the causal influence as triggers to ICT/e-government use as an outcome. The remaining percentage informed the need for undertaking participatory artefact simulation to uncover the other underlying mechanisms (74%) hidden from the model.

From an interventionist approach, the paradigm guiding the analysis of the data was situated within the Situation, Context, Mechanism and Outcomes (Pawson & Tilley, 1994; Pawson, 2006), presented in Table 21 below.



Table 21: Situation, Intervention, Context, Mechanism Outcome Configuration Framework

Aspects	Areas of application	Description
Situation	<p>a) Status quo establishment, ICT pre-usage beliefs and attitudes of citizens</p> <p>b) Problem of co-designers' cognitive artefact evaluation criteria from empathetic participatory design</p>	<p>a) Pre-usage beliefs and pre-usage attitudes of ICTs, demographics influence, level of prior actual use of ICTs (investigated in Case X, during DSR Y)</p> <p>b) Perception, comprehension, projection, participatory action learning, artefact features (investigated in Case X, during DSR Y)</p>
Intervention	Participatory design mindset, design thinking, design mindfulness	FindMe App, QuickApp, UBus App, Reportit App (identified in Case X, during DSR Y)
Context	<p>a) User and unit characteristics</p> <p>b) Requirements</p>	<p>a) SME type as unit, citizen characteristics featuring age, education level, marital status, gender, prior usage of computers</p> <p>b) System requirements: functional and non-functional, user requirements: citizen point of view, citizen goals, aesthetics</p> <p>c) Context requirements like the general environment</p>
Mechanisms	Behavioural and non-behavioural; observed and un-observed	<p>Behavioural as stimulus responses or actors' and participants' cognitive processes as invoked by specific interventions like attention, mindfulness, sense making, reflective thinking, empowerment, motivation</p> <p>Observed like log-on processes, actual use of interface</p>
Outcomes	<p>Use impact on community and citizens</p> <p>Participatory action learning</p>	Can be from mechanisms like attention, mindfulness, sense making, reflective thinking, empowerment, motivation
Configuration	Arrangement of the above components	Situation within a given context determines the nature of intervention. Intervention triggers mechanisms that result in desired or undesired outcome.

This study supplements the framework using lessons from Situation Awareness Theory, where a situation is differentiated from context. Situation denotes a problem and has or includes context with a focus on something threatening or undesirable. Situations can

also exist within a context. Situation awareness implies vigilance, awareness, and attentiveness to the context. In terms of causal inference, this study links the intervention (participatory design) with its specific outcomes within the chain. Mechanisms are brought about by an intervention so as to observe the outcomes. Mechanisms are enduring properties that generate events and non-events such that the events are ultimately perceived (experienced and observed). Configuration is the close link between the situation, contexts, intervention and the outcomes that are generated through triggering such deeply entrenched mechanisms.



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CHAPTER FIVE

PHASE ONE RESULTS: PRELIMINARY STUDY

*“Activities to demonstrate internal validity include precisely distinguishing the diverse unit of analysis, linking of the analysis to prior theory identified in a literature review, and presentation and analysis of **pilot** case studies,”* (Christie et al., 2000).

5.1 Introduction

The results presented here are from the pilot and preparatory study phase that report on the government’s (Ministry of Information Communications Technologies and National Guidance, Uganda) status quo regarding targeted e-government interventions for citizens vis-à-vis citizens’ needs. The chapter seeks to understand citizen needs through a co-requirements gathering process. With these results, the researcher was able to compare citizen needs to what government is currently offering them. The results of this phase of the study establish whether citizens’ requirements are aligned with government’s strategic e-government implementation initiatives. The researcher initially uses frequency counts gain high level insights into the design-reality gaps based on this pilot phase.

To a critical realist view, frequencies are used to estimate mechanisms so that question like to what extent, among whom and under what circumstances are examined. This is undertaken among high, middle and low frequencies due to a stratified ontology of CR. As mentioned earlier, during abductive and retroductive reasoning, as other non-critical realist philosophers discard the marginalized statistics like percentages (low percentages) that fall outside the limits, CR gives such data more treatment and explanatory power (Modell, 2015). Any difference in frequencies are high level pointers design-reality gaps. Table 21 provides a high-level summary of design science research process phases, research objectives, design activity, participants and key findings snapshot.

Table 22: Summary of Design Science Research Process Phases, Design Objective, Research Question for Those Objectives, Design Activities, Research Activities, Participants and Key Findings Snapshot

Phase	Design objective (DO) and associated Research Questions (RQ)	Design activities (DA) and research activities (RA)	Participants and rationale	Key findings
Pre-study/Pilot study	<p>DO: Model testing</p> <p>RQ: What are the differences in design expectations of the citizens in a health setting and what can government offer in terms of e-government use?</p>	<p>DA: Mapping pre-conceived problem of designer to user needs</p> <p>RA: Finding divergences and convergences between planned methods and tools and reality on ground through focus group discussions, community consultations and observations</p>	<p>Hospital stakeholders, so as to have a diverse design context. e-Government use is not limited to specific homogeneous context. It has been argued that the design-reality gaps are attributed inadequately understanding system context and diverse user context since systems are subject to multiple user accountabilities (Loudon & Rivett, 2013)</p>	<p>Government plans and e-health intervention and systems do not meet citizens in health setting's requirements</p>

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5.2 Response Rate and Demographic Characteristics of the Case Study Unit

The target population for this phase upon which the sample was drawn comprised of community leaders including religious leaders, government local leaders, village health teams, hospital management and local community leaders, all of whom have been hospital service recipients at one point in time. This was a key informants' focus group discussion conducted among 40 citizens. Table 23 below provides a summary of the members of the focus group discussion:

Table 23: Focus group discussion community informants

Key informants	Sector	Male	Female	Total
Clergy and religious leaders (Moslems, Christians)	Religious leaders	3	2	5
Government local leaders (Local Council one to Local Council three)	Government Local Representatives	2	3	5
Village Health Team members	Health community service providers (typical citizens selected and trained by Ministry of Health) to support care giving	3	17	20
Health Facility Management and Board Members	Management/ Board	4	1	5
Local Transporters (Motor Cyclists) known locally as <i>boda bodas</i>	Typical citizens	5	0	5
Association Leaders				
Total		17	23	40

The focus group involved 40 participants, among whom 42.5% were males and 57.5% were females. The majority of the respondents (50%) were village health team members who directly deliver services to the patients in their respective communities. These teams extend health services to the local level communities where health service access is problematic. Shidende and Mörtberg (2014) have termed such categories of people who extend the health services to the lower-level communities as *mediators*. They connect the communities to healthcare providers.

The mediators and community stakeholders represent multiple perspectives that enable project designers to move between various roles and aspirations and support collaboration between the local activity and the national intentions in respect to e-health. The use of percentages helps a critical realist researcher to assess the mechanisms operating among the majority and the minority forming small percentages (Stylianou & Scott, 2018).

5.3 Focus Group Results

The key informant stakeholders were divided into eight focus groups (each group having five members). The objective of the discussions was to establish what they needed for better, affordable and more sustainable health service delivery and health facility competitiveness. The leading question for this pilot requirement-gathering phase was: “How can a hospital in a resource-constrained environment maintain health service delivery at a low cost and enhance service accessibility and affordability to the poor population served?” This question allowed stakeholders to document and reveal innovative ways of ensuring health service viability and affordability among indigent citizens. The results, after undertaking thematic content analysis and categorization, using Atlas Ti, are presented in Table 24 below:

Table 24: Needs from Eight Focus Group Discussions with Stakeholders in a Potential E-Health Context

Themes	Frequency counts (n=8 groups)
Design strategies for insurance and medical benefits	4
Hospital should undertake school health visits	3
University students’ medical services should be covered by hospital	2
Fliers need to be printed and distributed	2
TVs, radio and newspaper advertisements need to be placed	4
Project proposals to funding agencies	5
Hospital website featuring a doctor booking form and a client complaint form should be designed	6

(Source: Focus group discussion needs)

The most frequent respondent need (number of groups=6) was an online web-based system. From the group presentations, one of the group presenters observed:

The private wing needs to be furnished with online booking services to improve accessibility and timeliness of care giving so that more private patients are attracted all over the country to enhance revenue for offering sustainable services to the other non-paying patients.

(Group presenter emphasis)

Another presenter commented,

The hospital has done enough to put in place medical equipment; we now need effective use. Let's put our services online to a wider community, be transparent and accountable to our donors and other partners. This will yield us more resource support.

(Focus Group Presenter)

A separate group member noted,

As a private patient, I want to come to the hospital and find my medical record sorted rather than be asked over and over again. Let's put services online rather than making us stand in line here.

(Presentation by a retired civil servant accessing services from the hospital)

The results of the FGDs are contrary to the modernisation theory and render support for the resource dependency theory by arguing that the haves should be at the forefront of spurring development to create a spill-over effect to the have nots. Such spillover effect leads to improvement in healthcare for poor citizens and communities. From literature, similar submissions have been made that include 'patient complaints help to identify problems in patient safety' and 'quality of clinical care' (Reader, Gillespie & Roberts, 2014); effective complaint handling systems help generate recovery strategies for a hospital's revenue and profitability (Tax, Brown & Chandrashekar, 1998); and implementation of Patient Care Information Systems (PCISs) is a potential means to achieving medical error reduction (Ash, Berg & Coiera, 2004).

During the plenary discussion of how such an online system would be of benefit to the marginalised, the following thematic patterns revealed themselves: web-based applications aid patient centeredness; patients are given more freedom in decision-making about their preferences for the appointments and have improved access; and improved online offerings to patients who can pay will improve poor non-paying citizens' services. For instance, one private patient paying UGSHS 300 000 (equivalent to ZAR 1000) can poll resources for 30 patients who are charged user fees of UGSHS 10 000 (ZAR 30) for one patient. So one paying patient whose service

satisfaction is improved through ICTs can offer a contribution to over 30 non-paying patients. This creates a positive spill over effect (externality) i.e. intangible benefits of ICTs as opposed to well-known tangible ones to the economically marginalised citizens. The next section presents results of the government’s plans in respect to design of e-health services for citizens.

5.4 Results from Government Ministries and Officials Responsible for e-Government and Other Related ICTs

Twenty (20) e-government officers were interviewed and sixteen (16) e-government policy documents were reviewed in order to ascertain the citizen-centric e-government services under the Ministry ICT strategic direction aimed at citizen’s engagement with government. The objective of the review was to examine whether there were successful citizen e-government projects, if any, as well as notable failures, crises or extreme cases as evidence for problematic or good e-government scenarios. The same criterion was used to sample government websites for further review and for data triangulation and verification. Moreover, informants’ interviews were arranged with the Ministry of ICT to establish and corroborate the information gathered from the policy documents. Such an alignment helped reveal points of convergence and divergence between the government e-government initiatives and the citizens in a health sector. Table 24 summarises response categories of the targeted officials involved in e-government design and implementation:

Table 25: E-Government Officers' Interviews

Respondent category	Number (N)	Gender	Status
Government officers (Interviews)			
Rural Communications Development Fund (RCDF) Manager	1	Male	Responded
Ministry of ICT (Permanent Secretary and Personal Assistant to the Minister of ICT)	2	Male	Responded
Business Process Specialist MoICT	1	Female	Responded in a focus group interview
Software Developer MoICT	1	Male	
Database Administrator MoICT	1	Male	
ICT specialist MoICT	1	Male	
Programmer MoICT	1	Male	
Other district level officers	7	Males	Interviewed
Other district level officers	5	Females	Interviewed
Total	20		

This stakeholder group of government officials is at the core of designing and implementing e-government citizen applications. They include rural communications development fund project officers and Ministry of ICT officers. These interviews helped determine the gap between the supply and demand sides of e-government for citizen applications.

From the Ministry documents, it was determined that e-government policy commitments are related to e-procurement processes, e-health, e-tax and e-education (UCC, 2002/3-2013/14). Under the Ministry of Health policy road map, online birth registration is yet another candidate initiative for ensuring that all children born within the health facility and communities are registered. The Uganda Ministry of ICT (2010) national e-government framework reveals that the identified priority applications and services are in line with the East African Community (EAC) and COMESA regional e-government initiatives.

The literature indicates that most national e-government initiatives are dictated by global pronouncements and as such may not be citizen specific. In terms of e-government implementation methodology, the Uganda implementation framework is in line with Heeks (2006: 169) who suggests that e-government project development typically consists of five stages: 1) project assessment, 2) analysis of current reality, 3) design of the new system, 4) system construction, and 5) implementation and beyond. The Ugandan e-government implementation model, also documented by Heeks (2006), and other e-government implementation maturity models follow traditional linear waterfall approaches that may not be consistent with developing solutions for citizens in marginalised communities, where non-linear approaches to design are more feasible.

Whereas e-procurement is a key application system government intervention area, it is not an e-service required directly by the underserved (marginalised citizens) as evidenced in the focus group interview results with the health setting stakeholders. Another intervention of concern on the side of government is public health reporting. However, the e-government strategy, based on the interviews with the officers, was not precise as to what such public health requirements should be and called upon universities and the private sector to take it on as a point of concern. When questioned about government support to universities enabling them to innovate solutions

for citizen needs, the officers noted that government does not solicit and only delivers based on their strategic plans and national priority areas.

With regards to the extent to which citizens' aspirations and needs are incorporated into the C2G e-government strategy, there are glaring design-reality gaps as the government shows no commitment to funding solutions to problems identified by the citizenry. Such a design scenario concretises the view that e-government design for citizens takes a top-down approach. For instance, one of the officers commented,

Government has meagre resources that cannot be directed to fund any proposals that are generated from citizens. We follow our master-designed roadmap bearing what we think works for the general community and funds will only be directed towards that.

(Interview, Ministry of ICT officer)

When it comes to involving the private sector to extend ICT related services to rural communities, the officer commented that it is not viable to extend services to such areas by telecommunication companies since such ventures are not profitable. He commented,

A company will not try and put 3G or 4G internet in the village since it is not viable at all. Many telecom companies have opted to serve the urban areas but we as government are trying to get the best requirements for the locals, but we are still failing.

(Interview, Officer RCDF)

It was revealed that resource allocation against government's set strategy was a key issue on the government side. From the citizens viewpoint, their aspirations and needs are in line with effective engagement with the hospital through web-based applications. Such demand and supply divergences are a form of the design-reality gap as also emphasized by one of the government officers:

It is good that you are working with youth in the universities to think aloud and develop interventions that speak to the citizens' needs. However, as a Ministry, we shall be able to point and support those that are in line with our strategy due to resource constraints. However, the desire would to fully implement whatever comes from the citizens, but we cannot. However, we appreciate the need to work with private partners to serve citizens better.

(Interview, Government officer).

Policy documents highlight and put emphasis on government being citizen-centric, but from the interviews of the government officers, there are no deliberate operational strategies to affect such a policy envisioned and a lot of designed projects meant for citizens have proven to be “white elephants” (E-government for development web, 2017; The East African Website, 2017).

Furthermore, from the health sector, Uganda’s national e-health policy (2016) observes that the Ugandan health sector is characterised by a fragmented landscape of ICT pilot projects and numerous data and health information system (HIS) silos with significant barriers to the effective sharing of information between healthcare participants. The policy further reveals that although the government, partners, and private institutions continue to invest in various ICT initiatives, without some form of a national plan and coordination, there is a real risk of continued duplication, ineffective expenditure, and the creation of new solutions that cannot be integrated or scaled across the continuum of care. A focus group interview with the application development team (including a business process specialist MoICT, software developer, database administrator, and ICT specialist and programmer all from the MoICT) noted that there is a lack of well-documented citizen-centric commitment toward design of most e-government applications. One of the officers noted,

While we want to design solutions for the locals, we actually have not known what such locals’ need. The business processing teams try to generate those needs but still, most times, our e-government interventions and projects have fallen short of such citizen groups.

(Focus Group Discussion, Application Development Team).

It is thus concluded that there exists design-reality gaps because the government’s planned e-government initiatives are not aligned with the citizens’ needs in the e-government health sector. Though government and e-government policy design teams have their conceptualised designs like an online birth registration system and clinical information (health informatics), for provision of health services at a distance (tele-health) and sharing information and knowledge with healthcare providers (e-learning) as per the Ugandan national e-health policy (2016), the citizens had a different perspective in terms of problem priority. This suggests the need for the design teams and e-government policy designers to undertake participatory problem discoveries and scoping during project designs. Kristensson *et al.* (2008) offers support for the results of the co-discovery phase where they note that participants must be exposed to problem discovery

methods that provide freedom to posit their views based on their own needs as opposed to going with pre-configured problems for design for them to rubber stamp. Sanders and Stappers (2011), too, offer similar guidance that co-design in a broader sense should ensure that creativity of designers and people not trained in design collaboratively work together in the design development process from the problem-definition phase to determine design outcomes. Van de Ven and Johnson (2006) emphasize that such cooperative working is the most critical way in which the gap between theory and practice can be bridged.



CHAPTER SIX

PHASE TWO RESULTS: PROBLEM DISCOVERY AND SCOPING

“The transition from developing technologies for users to developing with users has created the need to harness collective ideation,” (Ssozi-Mugarura, Blake and Rivett, 2015).

6.1 Introduction

The aims of this chapter were to a) establish citizens’ status quo regarding use of e-government services as a requirement for engagement with government; b) establish the selected citizens’ status quo regarding their beliefs, attitudes and ICT usage expectations; c) generate e-government requirements from the citizen perspective; and d) scope them down to serve as a point of departure for detailed design. This phase involves co-problem discovery among the design team from insights drawn from citizens’ presented ideas and perceived problems. These are further defined and scoped down by the design team during a co-definition phase to ensure that designable ideas and perceived problems are scoped into designable requirements. Owners of SMEs were selected for study in this phase. The researcher worked with SME owners because of the well-documented barrier to e-government, in respect to the lack of income to access the internet (Ebrahim & Irani, 2005; Zaidan, 2017). Moreover, the Uganda government through the Uganda Micro, Small and Medium Enterprise Policy (2015: 12) recognizes this group of citizens as crucial towards achieving employment and job creation targets of 90%. In this regard, ICT use has been prioritised as a strategy to improve their competitiveness and livelihood improvement. This group of citizens juxtapose the participatory design intervention so that their ICT expectations (positive and negative beliefs and attitudes) as discovered from the adoption theoretical frameworks can be mitigated during the collaborative working.

6.2 Response Rate and Demographic Characteristics

To have an understanding of current realities and status quo, the researcher conducted a survey to establish SME owners’ attitudes, beliefs, myths and expectations regarding ICT and ultimately e-government and related engagement issues. Table 26 provides an overview of the categories of the study participants:

Table 26: Livelihood Means of Survey Respondents

Citizen group	Frequency	Percent
Carpentry	30	7.1
Medical Centre	70	16.5
Drug shop	15	3.5
Pharmacy	65	15.3
Restaurant	50	11.8
Retail shop	50	11.8
School	60	14.1
Veterinary shop	20	4.7
Welding	65	15.3
Total	425	100.0

In total, 425 citizens from the SME sector were selected and involved in the survey through a disproportionate non-probability stratified random sampling. This is a sampling strategy where the sample size in each stratum need not be proportionate to the population size of the stratum (Stapleton, 2010). The stratum was based on livelihood means of the respondents.

In the Mukono Municipality, some citizens earn a living from marketing health-related products and services with ventures such as drug shops, clinics, health centres and pharmacies. Others earn a living through the sale of food and beverages in food stalls and kiosks, carpentry, veterinary drug shops, welding, nursery schools. Some work in supermarkets and hotels. The Uganda Investment Authority states that SMEs are the engine of growth for the economic development, innovation, and wealth creation in Uganda (SMEs Driving the Economy Report, 2016). These enterprises spread across all sectors with 49% in the service sector, 33% in the commerce and trade, 10% in manufacturing and 8% in other fields. Over 2,5 million people are employed in this sector, where they account for approximately 90% of the entire private sector, generating over 80% of manufactured output and contributing 20% of the gross domestic product (UIA, 2016).

6.3 Demographic Characteristics of Survey Respondents

The study sought to examine the demographic profiles of the participants within the SME sector. At the outset of this phase, it was anticipated the demographic profiles could influence both ICT usage behaviour and the participatory design outcomes. Authors have observed that such

demographic characteristics and livelihood means as a socio-economic factor determines the ICT design involvement and adoption decision of a given community context (Akudugu, Guo & Dadzie, 2012). Table 27 presents the profiles of the citizens involved in this survey within the sector:

Table 27: Demographic Profiles of Citizens

Profile		Frequency	Percent
Valid	Female	185	43.5
	Male	240	56.5
	Total	425	100.0
		Frequency	Percent
Valid	Single	130	30.6
	Married	265	62.4
	Divorced	20	4.7
	Widowed	5	1.2
	Total	420	98.8
Missing	System	5	1.2
Total		425	100.0
		Frequency	Percent
Valid	Age <35 years	240	56.4
	>35	185	43.6
	Total	425	100.0
		Frequency	Percent
Valid	less than primary	10	2.4
	Completed O-level	30	7.1
	Completed A-level	40	9.4
	Completed tertiary education certificate	55	12.9
	Ordinary Diploma	55	12.9
	Advanced diploma	55	12.9
	Bachelor's degree	120	28.2
	Postgraduate Diploma	20	4.7
	Master's degree	35	8.2
	Total	420	98.8
	Missing	Non-response (dropped)	5
Total		425	100

Female citizen respondents represented 43.5% of our group, while male respondents accounted for 56.5%. This suggests male dominance in SMEs, and this may hold true since, culturally in

Central Uganda, men are regarded as the breadwinners and must find alternative means of survival in the absence of formal employment.

From this study, 30.6% of the respondents were single, 62.4% were married, 4.7% were divorced and 1.2% were widowed. The majority of participants was aged below 35 years (56.4%) while 43.6% were above 35 years of age. The level of education was another key demographic variable deemed necessary for participatory design activity to take place. From the results, 2.4% had a level below primary, 7.1% had completed ordinary level education, 9.4% had completed advanced level education, 12.9% had completed a tertiary education certificate, 12.9% had an ordinary diploma, 12.9% had an advanced diploma, 28.2% held a Bachelor’s degree, 28.2% had a postgraduate diploma and 8.2% held a Master’s degree. SMEs have earned a reputation for being indulged in by people of low education status, which may not necessarily be the case.

6.4 Prior Use of ICT

The survey assessed prior use of ICT amongst respondents, given that it is a pre-condition for e-government access and use (Table 27):

Table 28: Use of a Computer for Business or Other Purposes

Have you ever used a computer (desktop or laptop) for your business?		Frequency	Percent
Valid	No	290	68.2
	Yes	135	31.8
	Total	425	100.0
Have you ever used a computer (desktop or laptop) for any other purpose?		Frequency	Percent
Valid	No	388	91.3
	Yes	35	8.2
	Total	423	99.5

It should be stated that mobile phones in Uganda have a greater penetration than desktop computers and laptops. However, the government of Uganda is aggressively implementing District Business Information Centres through the supply of desktops and laptops. Of the SME owners interviewed, 68.2% have never used a computer system in their business and 76.5% have never used a computer-based system for any other purpose. From this, it can be inferred that the level of usage of ICTs among selected citizens in the study area is low – 91.3% have never used computers in any form apart from business and only 8.2% had ever used a computer. This

implies that of 100 typical citizens, less than 10 have used a desktop or laptop. It can be concluded that the level of usage of ICTs is extremely low. This explains the low usage of e-government application and other related e-services (Stienstra & Troschuk, 2005; Ndou, 2004). The researcher further examined the perceptions of citizens concerning low usage and possible explanations of such phenomena.

6.5 Pre-usage Expectations, Beliefs and Attitudes

This section examines the factors that underpin pre-ICT usage among the selected citizens in Uganda. The researcher categorized pre-usage issues as negative perceptions (7 items) and positive perceptions (7 items). Such perceptions are based on the Pareto rule, where it is claimed that 80% of user perceptions are negative while only 20% of their perceptions towards available ICT applications are positive (Oztekin, 2011; Oztekin. *et al.*, 2013). When users hold negative perceptions towards available ICT applications, low adoption or non-adoption prevail and such systems remain under- or unutilised (Kim, Chan & Gupta, 2007; Verdegem & Verhoest, 2009). The researcher examined features of the distribution as the mean and standard deviation in order to assess where the average or typical values lie and how spread out they are. This is illustrated in Table 29 below.

Table 29: Descriptive Statistics on the Pre-System Usability Issues

	Responses	Negative perception	Positive perception	Mean	Std. Dev.	Analysis N
1	I think using system can improve my business		√	3.89	1.178	380
2	Use of a computer system can improve my well-being		√	3.74	1.057	380
3	Computer use is not a waste of time		√	4.04	.967	380
4	I think the computer system is not too complex		√	2.71	1.308	380
5	I think I would like to use a computer system frequently		√	3.50	1.166	380
6	I think I can gain something from the use of computers		√	3.91	.977	380
7	I imagine that most people can learn to use the computer system		√	4.01	.981	380
8	I do not feel very confident using the computer system	√		3.46	1.411	380
9	I think the computer system is not easy to use	√		3.38	.726	380
10	I need support from another person to use a computer system	√		4.00	1.090	380
11	I need to work with somebody technical before use	√		4.26	.993	380

12	There might be too many inconsistencies in a computer system	√	1.95	1.257	380
13	I think the functions of the computer system are not well-integrated	√	1.71	1.158	380
14	The computer system is very cumbersome to use	√	3.21	1.372	380

For Table 29, missing data was sifted out and the mean results provided are for the responses recorded. Based on the structured tool, mean results tending towards one (1) reveal a strong disagreement, whereas those towards five (5) reveal a strong agreement of all factors 1-14. From the above statistics, citizens have positive perceptions about most constructs. For instance, they strongly disagree that computer use is a waste of time. However, they do not believe that most people can learn how to use a computer system, which tallies with their other belief that they are not confident using the computer system. This points to some form of negative attitude similar to learnability.

However, to avoid arbitrary categorization, the researcher undertook factor analysis to examine the data. Modell renders support for this approach by emphasizing that the development or refinement of theoretical concepts based on small-scale pilot studies is frequently combined with statistical techniques such as factor analysis to determine the degree of convergence (Modell, 2005, 2009). Such factor analysis aligns with the critical realist’s view that it helps to examine mechanisms within social events and how they are constituted through the intersection of two causal powers – those of social practices (and, behind them, of social structures), and those of social agents (Fairclough, Jessop & Sayer, 2004). Such causal powers could constrain the use of technology.

6.6 Principle Component Analysis

The next step of analysis involved PCA to determine multi-collinearity of the fourteen latent variables indicated in Table 29. Modell (2009) argues from a critical realist’s perspective that the development or refinement of theoretical concepts based on small-scale qualitative pilot studies is often combined with statistical techniques, such as factor analysis, to determine the degree of convergence with quantitative measures of a particular phenomenon. Converging findings increases the likelihood of theoretical constructs to explain an observed or unobservable mechanism within an event and their operational definitions capturing various phenomena with

greater precision. PCA provided an indication as to whether there was a patterned relationship amongst these variables. The results of preliminary analysis revealed a determinant score of 0.011 that is above the rule of thumb of .00001 indicating an absence of multi-collinearity.

6.6.1 Factor Rotation and Extraction

The researcher undertook oblique rotation to allow for a correlation of factors as they are aimed at establishing determinants for use of ICTs among selected participants. Varimax was used to scale the loadings by dividing them by their corresponding communalities. This section examines the total variance (Table 30) to determine the number of significant factors. Only extracted and rotated values are deemed meaningful for the next interpretation. The factors are arranged in the descending order based on the most explained variance.

Table 30: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.830	27.354	27.354	3.830	27.354	27.354	3.239	23.133	23.133
2	1.764	12.598	39.952	1.764	12.598	39.952	1.508	10.768	33.902
3	1.284	9.171	49.123	1.284	9.171	49.123	1.440	10.289	44.190
4	1.173	8.381	57.504	1.173	8.381	57.504	1.405	10.039	54.229
5	1.118	7.986	65.490	1.118	7.986	65.490	1.349	9.638	63.867
6	1.071	7.652	73.142	1.071	7.652	73.142	1.298	9.275	73.142
7	.892	6.370	79.512						
8	.680	4.855	84.367						
9	.617	4.404	88.771						
10	.460	3.289	92.060						
11	.349	2.492	94.552						
12	.307	2.194	96.746						
13	.264	1.884	98.630						
14	.192	1.370	100.000						

Extraction Method: Principal Component Analysis

From the rotated Eigenvalues, the number of significant factors is six (6) for this study. The results in the table above suggest that common themes from the fourteen (14) items are categorized into six (6) factors. Table 31 shows the rotated factor matrix to aid factor naming. The themes were coded onto six components.

Table 31: Rotated Component Matrix

Items	Component					
	1	2	3	4	5	6
I think using systems can improve my business	.815					
Use of computer systems can improve my well-being	.787		.322			
Computer use is not a waste of time	.720				-.360	
I do not feel very confident using the computer system	.712					-.401
I think I can gain something from the use of computers	.644	-.354				
I think the computer system is not easy to use	.448					.457
I think the computer system is not too complex		.858				
I think I would like to use a computer system frequently	.464	.688				
I need support from another person to use a computer system			.815			
I do need to work with somebody technical before use			.745			
I imagine that most people can learn to use the computer system				.826		
There might be too many inconsistencies in a computer system				.740	.318	
I think the functions of the computer system are not well-integrated				.652	.889	
I guess the computer system is very cumbersome to use						.860
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
Rotation converged in 8 iterations.						

The rotated factor loadings show that the factors are desirable with at least three variables per factors that are above .32 as per acceptable levels (Field, 2009).

6.6.2 Assigning Names to the Identified Factors

Naming of factors is more of an art than a science, as there are no rules except to give names that best represent the variables within the factors (Costello & Osborne, 2005; Yong & Pearce, 2013). Other scholars assert that naming can come from the from the investigator's prior theoretical understanding of the phenomenon under study (*a priori* approach) as the factors get loaded to a component (Ryan & Bernard, 2003). The naming of the factors in this study was based on the above factor loadings, labelling used in common practice, intuition in respect of the research context and theoretical lenses and combined knowledge among the study teams.

Factor 1: Benefit Expectation

The first factor has three variables that relate to the expectation that using computers can improve business, that it does not constitute a waste of time, and that traders would like to use a computer more frequently. These issues align well with the notion of business benefit expectations. The other issues seem to relate to personal benefit expectations from use of computers, which include the notion that the use of computers would improve well-being. I therefore cast both of these as benefit expectation.

Factor 2: ICT Learnability

The second set of three variables are related the perceived ability of individuals to learn to use ICT. These are associated with latent variables in respect to feeling an aptitude to learn something of value through ICT use, perceiving computers as not being complex and the need to use computers frequently.

Factor 3: ICT Support

For factor three, I consider two key variables: a need for support from another person to use a computer system and not simply someone with technical knowledge; the implication that any peer who can offer support can enhance usability. These are issues related to anticipated ICT support as an expectation prior to use.

Factor 4: Ease of Use

This factor relates to the ease of which a trader is able to learn to use computers, and that during their use, there is an expectation of inconsistencies in the system. These are system design-related issues, and are therefore labelled as 'ease of use'.

Factor 5: User-Centeredness

The latent variables associated with this factor appear closely related to factor four. These include an expectation of inconsistencies in the system and the expectation of computer systems to be well-integrated. These are premised on notions of user-centred design. This factor may

warrant further investigation in further studies, but at this point I decided, based on the statistical analysis, to keep it as a separate factor.

Factor 6: User Confidence

Finally, the sixth factor relates to the system being cumbersome, as revealed by one of the variables loading highly with 0.86, coupled with a not perceiving computer use to be easy and issues related to lack of confidence. I label this factor ‘user confidence’.

6.7 Towards Understanding Pre-usage Antecedents and Expectations for an e-Government Participatory Model

The above six factors formed the foundation of a preliminary construction of a citizen-based ICT participatory design model for developing contexts:

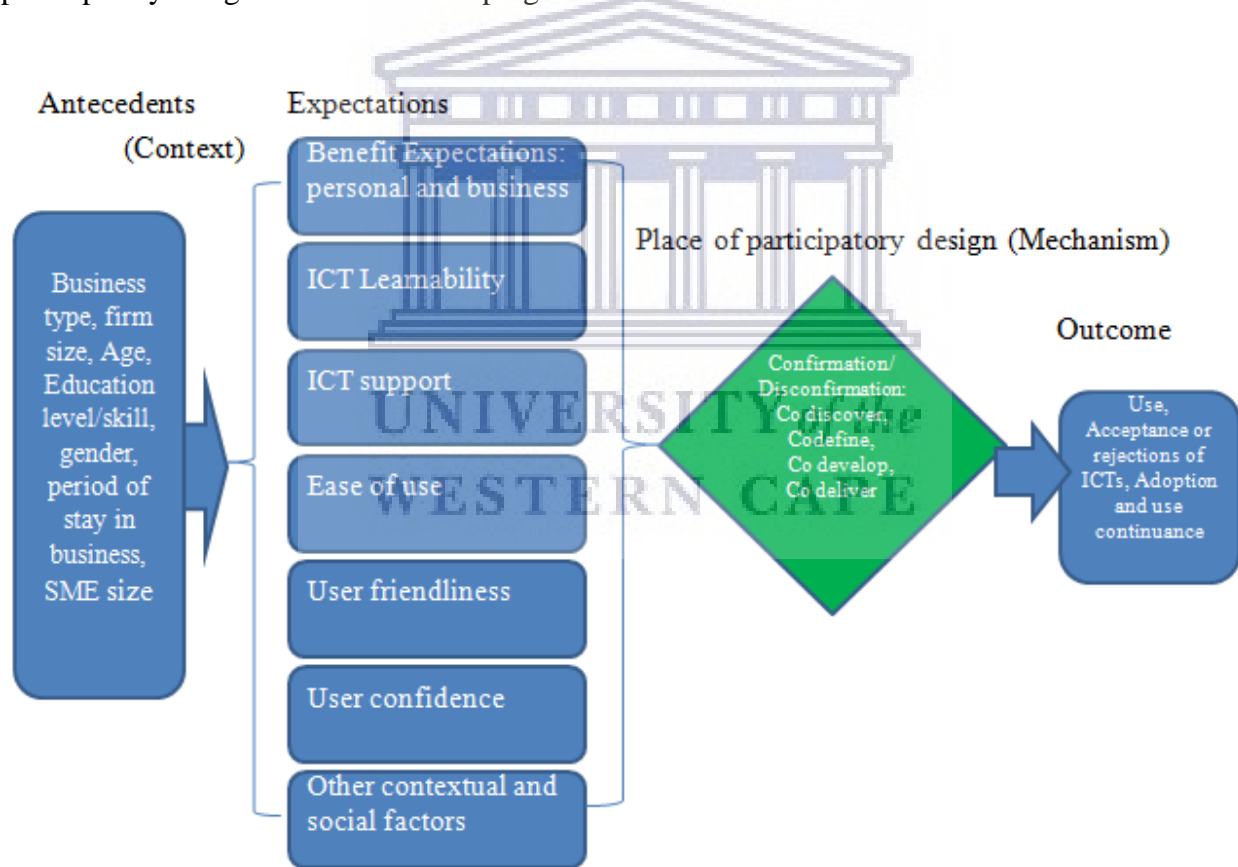


Figure 24: Towards an e-government participatory design model

The determinants of ICT adoption were grouped as benefit expectations, learnability, ICT support, ease of use, user friendliness, use confidence and other contextual and social factors not

revealed during the factor analysis (Figure 26). The green diamond implies that during participatory design process, the expectations can be confirmed or disconfirmed into mental divergence and convergence. The mental convergence of the designers and systems users leads to better usage outcomes. From the above results, the next phase was to ascertain the extent to which the underlying mechanisms influence ICT use among the citizen groups based on the SME category using statistical inference to explain the causal inferences. Furthermore, the phase aimed at understanding differences among the different cases.

6.8 Statistical Inference to Explain Causal Mechanisms

From a critical realist's perspective, there is need to suggest statistical models of causal process to explain or estimate causal mechanisms operating at a micro-level (Hedström, 2008). An awareness of relevant mechanisms is necessary for statistical inference and estimates are important to understand the process by which something has been generated (Perer & Shneiderman, 2009). Some statistical models that critical realists use to study such causal mechanisms include, though are not limited to, Analysis of Variance (ANOVA) and regression (Ron, 2002).

6.8.1 Pre-usage Expectations Stratified by SME Sector

In order to understand the differences between ICT usage expectations that could influence design outcomes, stratification was employed against the pre-usage issues and a One-Way ANOVA was applied. Based on Pawson and Tilley's (1997) theory driven approach that focuses evaluation on what works, for whom and in what circumstances, ANOVA is a viable analytical technique used to examine relationships of context-mechanisms-outcomes configurations (CMO) (Orovioigoicoechea & Watson, 2009; Hawkins, 2014). Furthermore, a one-way ANOVA Post Hoc using the Tukey HSD test helps categorize users using their profiles, thereby yielding a stratified ontology. I grouped the items in the questionnaire to depict the six variables as composite measures and ran a one-way ANOVA. The results were as presented in Table 32:

Table 32: One Way ANOVA Results

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
BENEFIT EXPECTATIONS	Between Groups	34.756	8	4.345	15.494	.000
	Within Groups	111.041	396	.280		
	Total	145.798	404			
ICT LEARNABILITY	Between Groups	90.068	8	11.258	17.839	.000
	Within Groups	259.382	411	.631		
	Total	349.449	419			
ICT SUPPORT	Between Groups	133.615	8	16.702	17.227	.000
	Within Groups	364.535	376	.970		
	Total	498.149	384			
EASE-OF-USE	Between Groups	10.586	8	1.323	3.224	.001
	Within Groups	160.463	391	.410		
	Total	171.049	399			
USER-FRIENDLINESS	Between Groups	25.355	8	3.169	5.892	.000
	Within Groups	213.009	396	.538		
	Total	238.364	404			
USER-CONFIDENCE	Between Groups	51.290	8	6.411	10.787	.000
	Within Groups	241.301	406	.594		
	Total	292.590	414			

The above results reveal that there is a statistically significant difference among citizens with regard to their pre-usage e-government and other related ICT perceptions among all citizen groups (significance value is below 0.05 throughout).

6.8.2 Examining the Extent to Which Pre-Usage Expectations Determine

Actual Usage

Though OLS-associated regression analyses are generally conceived as tools of empiricism and law-like, the researcher goes by Roy Bhaskar's view of laws that they should not be understood as descriptions of constant conjunctions of events but as tendencies of 'powerful particulars' (Bhaskar, 2013). Thus, when a scientist utilizes a regression model, they are describing a property of a structured entity, and not trying to predict in a specific circumstance if the entity will behave in a specific way. According to Ron (2002: 133), use of regression analysis with a critical realists' lens involves three stages: in the first stage, regularity is observed; during the

second stage hypothetical causal mechanism is offered to explain the regularity; and during the third stage scientific activity is directed at isolating the mechanism itself. Below are the Ordinary Least Squares (OLS) for estimating the explanatory power of the e-government pre-usage determinants on actual use among the selected citizen groups:

Table 33: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	.420 ^a	.176	.163	.27008	.000

Predictors: (Constant), Benefit Expectations, ICT Learnability, ICT support, ease of use, User friendliness, User confidence

From table 33, it can be observed that an R-Square value of 0.176 is generated. This implies that 17.6% of variations in ICT prior use among the selected participants is explained by the six pre-usage expectations. The other 82.4% of the variations is explained by other factors not exploited in the regression model. The sig. value of 0.000 implies a statistically significant influence of the examined perceptions on actual use of ICTs. Below are the regression coefficients (isolating the casual powers) in table 34:

Table 34: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.761	.107		16.51	.000
	Benefit Expectations	-.024	.090	-.049	-.267	.790
	ICT Learnability	-.104	.039	-.328	-2.653	.008
	ICT Support	.003	.023	.012	.135	.892
	Ease o Use	.068	.033	.146	2.026	.043
	User Friendliness	-.079	.042	-.204	-1.869	.062
	User Confidence	-.002	.021	-.005	-.093	.926

Dependent Variable: Actual Use

It can be observed that the most significant perceptions to predict actual use of ICT services are learnability (sig. 0.008) and ease of use (sig. 0.043). However, the coefficient of determination of 17.6% implies that the other 82.4% of usage determinants comprise other factors. These must be assessed during the participatory design process.

The researcher posits that, to improve e-government adoption and effective use among marginalised citizens, a participatory design approach is the best. This comprises four key

activities viz. Co-Discover, Co-Define, Co-Develop and Co-Deliver. The author theorised that participatory design is a “double-edged sword” that can influence citizen’s pre-usage expectations while improving and contributing to effective adoption as an outcome.

Foregoing Figure 26 reflects various components inherent in a participatory design process which lead to outcomes of acceptance, adoption and continued use, as follows:

- It is first important to examine the fundamental demographic factors to understand the potential user population. The data in this study indicates that there are variances in pre-usage beliefs and attitudes among citizens that could be explained by their demographic context. It is hypothesized that co-creation has the potential to comprehensively reveal the influence of such demographics on the user’s expectations of ICTs.
- Next, the six factors identified in this study should form a basis for informing the processes inherent during the application of the participatory design mechanism. Such expectations can be confirmed or disconfirmed when developers undertake co-design during the stages of ICT artefact design, viz. Co-discovery of the problem, Co-definition of the problem, Co-development of the solution and its Co-delivery.
- The pre-usage beliefs and attitudes together with the citizen status quo are established through the collaborative design process.

Several other studies have also argued that co-creation or participatory design could foster a more effective adoption strategy (Ngugi, Johnsen & Erdélyi, 2010; Lee, Olson & Trimi, 2012; Bigliardi & Galati, 2013). Davis (1993), who created TAM, concluded that there is a need for mechanisms by which design choices influence user acceptance within applied contexts. For example, the community informatics literature reveals that with the design of applications, projects and activities within a community informatics framework that would be most supportive of local "effective use" would be "participatory design" (Gurstein, 2003). Participatory design is a well-cited strategy (Porter, 1991; Qureshil, Kamal & Wolcott, 2009; Wyche, 2015) and its application has proven fruitful.

The researcher also undertook thorough face-to-face interviews to examine the other issues (82,4%) not covered in the regression model. This was undertaken as a co-problem discovery exercise where citizen requirements were determined for the design of e-government service applications using direct interviews. The next section presents the interview results.

6.9 Interview Results Revealing Citizens' Real Needs in Respect of e-Government Services

From the 425 participants, selection for interviews was based on SMEs stratum to have a multiple-view problem context. The original stratum at the ICT utilisation status quo was maintained. These were stratified based on livelihood means: carpentry, medical centres, drug shops, pharmacy, restaurant, retail shops, schools (pre-primary and primary privately owned), veterinary shops and welding. From each of the nine (9) strata, ten (10) participants were selected for the interviews based on their willingness to be part of the co-design team for the period of study. Respondents were asked to suggest their e-government application needs. The requirements are summarized in table 35 below.

Table 35: e-Government Service Needs Tally Sheet

Citizen sector	Citizen e-government service requirements					Sector requirements (SMEs)			
	Crime reporting	Kidnap reporting	Fire outbreak reporting	Hard to reach areas transport booking	Networking	Business reports generation	Customer database	Internet access	Records keeping
Carpentry	8	9	10	6	2	2	3	8	3
Medical centre	7	7	9	7	3	7	8	7	7
Drug shop	8	8	8	6	3	7	7	8	7
Pharmacy	8	8	9	7	4	2	2	7	3
Restaurant	7	8	7	6	5	2	2	8	3
Retail shop	8	8	8	5	4	8	6	9	5
School	9	10	8	5	4	3	3	8	3
Veterinary shop	8	8	8	6	4	7	7	7	6
Welding	8	8	9	6	5	1	2	8	3
Total	71	74	76	54	34	39	40	70	40

The needs above are grouped based on frequency counts yielded through content analysis. The results are in table 36 that follows:

Table 36: Interview Results Table for E-Government Service Requirements Warranting Application Designs

Personal and community related needs	Frequency	Percent
Reporting crime at business and home	71	78.9
So many kidnaps of our people (children and women)	74	82.2
Reporting fire outbreaks in our business and communities and schools	76	84.4
Hard methods of booking for transport to go to township	54	60.0
Networking with other people and businesses	34	37.8
Total	309	68.7%
Business related needs		
Reporting systems	39	43.3
Customer database	40	44.4
Internet access	70	77.8
Record keeping system	40	44.4
Total	189	52.5

Most of the e-government service requirements suggested by the interviewees were framed around personal/citizen-level and community-level needs. The first four e-government service requirements (reporting crime at businesses and homes; kidnaps in community among citizens, women and children; fire outbreaks in communities, schools and businesses; challenges of booking scarce transport to townships) formed the basis for design continuity.

The design involved the first four problems as the co-design team was in four groups. Each group, while working with the interviewees generating the problems, were asked to provide a description in detail as well as an appropriate name for the prototype to be designed. The following problem elaborations and prototype names were advanced by each of the groups:

- *Crime at work and home:* A neighbourhood home or business (SMEs) application that monitors crime, theft or similar incidences for public safety. It was named ReportIt.
- *Kidnappings of women and children:* An application intended for use by a kidnapped victim to signal authorities or government security agencies like the police for emergency response. This was a common problem among SMEs as victims fall prey to criminals who think they carry money home from work. The application was named FindMe.
- *Fire outbreaks at work and school:* A fire-reporting application in case of fire outbreak at schools to offer real-time response by government agencies. It was named QuickApp.

- *Booking transport to go to township:* Some respondents reported that they were located far from city centres and yet buses traverse the city where they conduct business transactions. A bus or transport booking system using mobile money as a payment method was proposed to the design team. This is an application for booking a bus for public transport in a constrained environment where transport is not easily accessible. It was named UBus.

The following chapter reports the results of the empathetic participatory design by the co-design team to fine tune the prototype prior to simulating among the communities. The above citizens' requirements (problem domains) therefore offer an impetus for undertaking detailed designs starting with empathetic participatory design.



CHAPTER SEVEN

PHASE THREE RESULTS: EMPATHETIC PARTICIPATORY DESIGN INVOLVING THE CO-DESIGN TEAM

“As designers, we need to be design mindful conceptualized as ‘The Power of Thinking Ones’ Thinking to Thinking about Others,” (Plaza et al., 2013).

7.1 Introduction

“How can we build the ideas and practices of mindfulness into technology so that the attention and well-being of people who use it are best supported?” (Dernbecher & Beck, 2017). One answer to such a question as has been published by Kyakulumbye, Pather and Jantjies (2019) in the *Electronic Journal of Knowledge Management*, 17(1) is an empathetic participatory design process. Whereas the Behavioural Science Paradigm seeks to discover and verify laws or principles that explain or predict human or social behaviour, the Design Science Paradigm seeks to extend the boundaries of human and social capabilities by creating new and innovative artefacts (Hevner & Chatterjee, 2010). This study adopted a participatory design approach that is not only a method or set of methodologies but a mindset and an attitude about people (Sanders, 2003). Participatory design acknowledges an accountability of design to the lives of those who will be affected by the process and its outcomes (Norman, 1988; Norman, 1999; Stolterman, 2008). In terms of knowledge creation and dissemination, from a participatory design point of view, users who possess tacit and/or explicit knowledge, may be brought into the design space to work with the designer who may already have a wealth of both knowledge types.

This chapter reports on how co-design team members generated their tacit and explicit design knowledge to enrich the design process and outcome before and during the typical user experiencing design phase. The researcher refers to this approach of design as “empathetic participatory design” as adopted and modified from various scholars like Lindsay *et al.* (2012), Kouprie and Visser (2009), Hawley (2007) and Sanders (2003) who termed it ‘empathetic user experience design’. It is empathetic as it highlights the importance of better understanding a prospective user audience by living through common experiences or facing the same challenges related to usability that they do (Kyakulumbye, Pather & Mmaki, 2018; 2019). Empathetic design includes the word *participatory* because it enables the design team to make appropriate

choices for others who are unlike themselves (Kouprie and Visser, 2009). Empathetic design has roots in relation to design when listening to client responses on questionnaires was not enough to develop successful artefacts (Sanders, 2003). Most of the results in this chapter, published in Kyakulumbye, Pather and Mmaki (2019), focus on the following objectives presented in table 37 below:

Table 37: Research and Design Objective of the Empathetic Participatory Design with Design Team

Design Research phase	Design and research objective	Design activities	Unit of analysis	Explanatory notes
DSR2	<p>DO: To investigate how the profile of the citizen user through co-designers' empathetic participatory designs may be understood to influence the design outcome</p> <p>RQ: <i>To what extent do user profiles influence cognitive criteria artefact evaluation? What are the viable tools and methods for empathizing usage requirements from co-designers' perspectives?</i></p>	<p>DA: Persona development using low-fidelity paper prototypes, role-plays (expressive user persona) through empathetic participatory design</p> <p>Paper prototypes are used as communicating tools (props) during role-plays</p> <p>RA: Repertory grids artefact evaluation</p> <p>Observations through expressive user persona</p> <p>Artefact evaluation structured questionnaires for visibility and cognitive evaluation</p>	<p>Co-design team members as real designers, researchers' user empathizing, and citizen roles, persona and scenarios</p>	<p>Perception cognitive artefact evaluation criteria is most key for users during empathetic process</p> <p>Designer demographics during empathetic participatory design have an influence on the cognitive information processing criterion of users</p> <p>Expressive user persona is key to understanding and simulating the lived experiences of communities</p> <p>Repertory grids generate diversified constructs, but it is not clear to users who lack explicit knowledge to undertake naming of tacitly generated constructs. The autonomy of the researcher in supporting the team to realize this is key</p>

7.2 Empathetic Participatory Design and Artefact Evolution and Improvement for Design of Citizen-Centric Applications

The best way to understand user issues from a designer perspective is through the empathetic participatory design approach that the study adopted. This study's design methods and activities included paper prototyping, role-play, user personae, user scenarios and user cases while working collaboratively with 28 co-design team members. Their detailed explanation was described in the methodology chapter (Chapter 6, Section 6.3). This section reports the results. An example of persona, use scenarios and user cases drafted by co-design team members in textual and graphical form are presented in figure 27 below.



Figure 25: Example of a Reporting Application User Persona (Source: Kyakulumbye, Pather & Mmaki, 2019)

The above profiled user is to report an incident like a fire using a mobile application. She logs onto the app by entering login details (email and password). She is an existing user of the mobile web interface, so she does not have to sign-up as a new user. The system must now check the correctness of the user's login details. If the login details are correct it will take the user to the menu page showing the mobile applications options. The user will then click on the watch option to report the crime, kidnap or fire. The user will select the incident activities where the user must first choose the date, time, location,

description or record a voice note. She must then click confirm if the information is correct. The user will then receive a confirmation message if the report has been successfully submitted.

From similar user personae, use cases were generated to support the investigation of the data flows among users and designers. Below is a sample use case for one of the incident reporting applications.

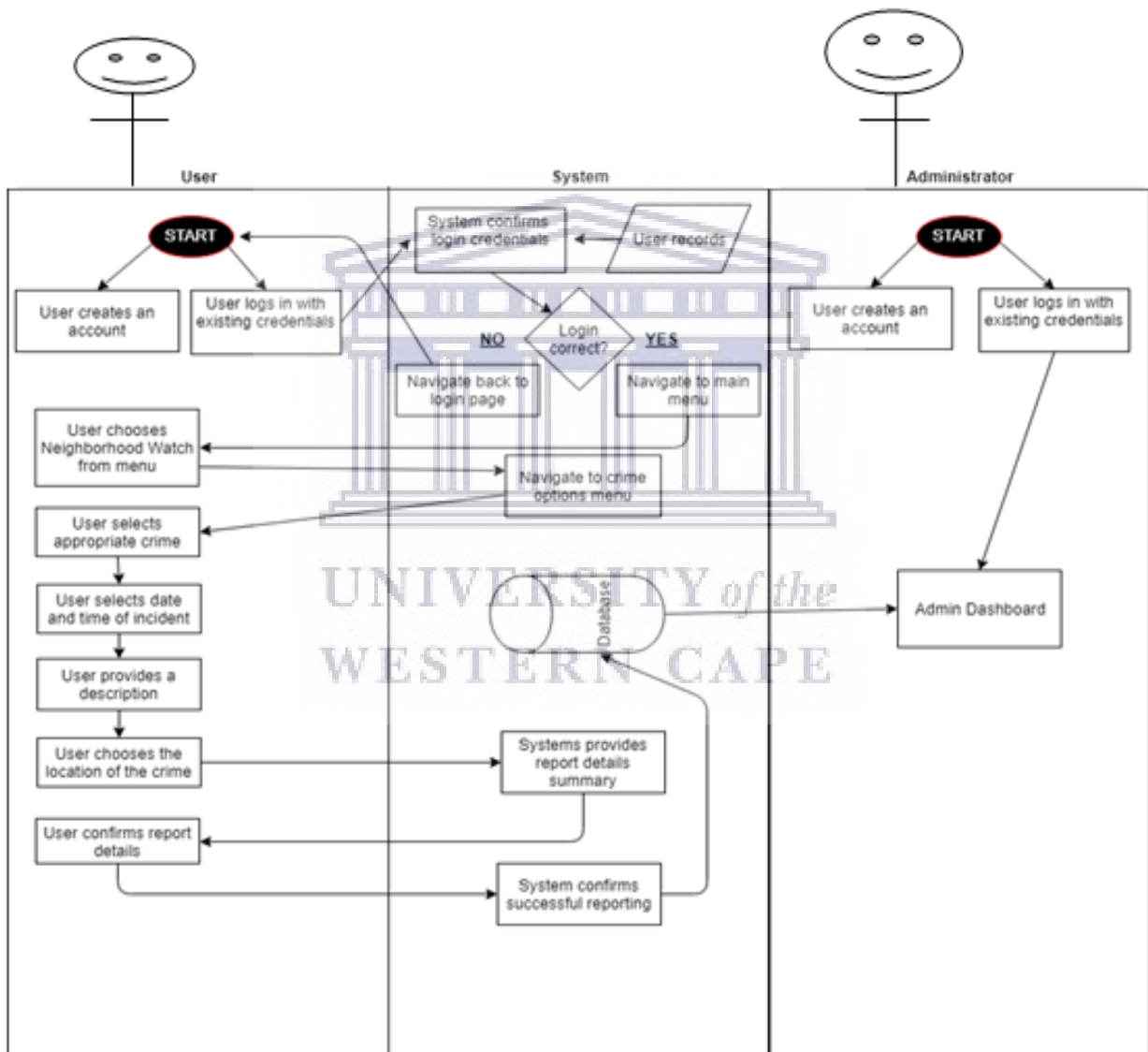


Figure 26: Incident reporting use case
 (Source: Researcher generated from empathy design process)

The use persona and use cases reveals that user profiles are closely linked to user-product interaction acceptance. Notably, four basic factors play a role in human-product interaction: the product or system, the user, their goal, and the context in which the interaction takes place. How usable a product is depends on the user, their goal with the product, the product properties and the context in which the product is used (Wever, Van Kuijk & Boks, 2008). Despite many designers using Unified Modelling Languages (UMLs), though, they do not give a real process-based use of the artefact. It is not easy to estimate how long it takes to complete a given task, until such drawings are blended with body storming like the expressive user persona used in this study.

A *persona* is described as one or several fictitious characters that can represent the majority of potential users of a system with conventional user demands (van Os & van Beurden, 2014). For this study, personae helped describe the whereabouts, demographics, problems, beliefs and attitudes of intended users. They were created from text or graphics and pictures to communicate a clearer image, leaving less to the imagination and thus creating a common understanding as to who the target people are. After designing the initial paper prototypes based on the co-designer's concept models, the applicable persona was the subject of role-play, herein termed as "expressive user persona". To develop clear user characteristics and demographics, co-design team members were encouraged to discuss the potential system user through empathy phases as detailed by scholars like Kouprie and Visser (2009). As a designer empathizing through expressive user personae for a better definition of roles, two components of personae have been documented – emotional and cognitive (Kouprie & Visser, 2009; Bevan, Pfyl & Barclay, 2012).

For designers, the recommendation is that awareness of both emotional and cognitive components is essential. One of the two components will not suffice without the other. Having an emotional response (affective) to another's emotional state and reflecting on that by gaining perspective (cognitive) is the core mechanism of empathy (Kouprie & Visser, 2009). Creating the right balance between affective resonance and cognitive reasoning is a basic concern of empathy. Designers were trained to gain understanding of the user (cognitive), by feeling the user's emotional state (affective) through practice exercises during repertory grid training (Appendix 7b). These exercises served to enhance the co-designer's experiences while preparing

them for the user-experiencing phase, the next key phase of this design science research. In discovery and design, if the stratified ontology of the real, actual and empirical is to be understood, there is a continuum that extends from being told about something, to seeing for yourself, to doing it yourself. Key to this section is the Buchenau and Suri (2000) quotation that reads, "*What I hear, I forget. What I see, I remember. What I do, I understand.*" This phase involved four sub-phases explained below.

Discovery – Empathetic participatory design allows for experiencing the design applications in new ways. With the design team assuming the lives and emotions of others, new modifications can be made to the usage environment (e.g. interfaces, colours, icons, sign-in tools). Through in-house simulations, the design team is able to discover or make modifications to the way in which a user would interact with the system (e.g. limited visibility due to interface darkness, limited hearing, nature of background noise). Such empathetic user experiences are designed to break the mould of the user's thought processes and usage patterns, thereby encouraging the design team to think about the system in new ways and consciously articulate the type of user needs that lead to breakthrough products (Lin & Seepersad, 2007; Sleeswijk Visser, Van der Lugt & Stappers, 2007; Liedtka, 2015).

Immersion – The design team was encouraged to wander in the user's world and take the user's point of reference (my experience is your experience). After the first encounter with the user's experience, the designer took an active role by leaving the design office and wandering around in the user's world. The designers were encouraged to expand their knowledge about the user and to generate surprising situations by various aspects that influence the user's experience. The designers had to be open-minded, interested in the user's perspective. The design teams were pulled into the user's world and absorbed without judgment. Such direct immersion into the exposure to user perceptions helps designers explore design problems, channel their efforts, and reduce or avoid design fixations (pre-conceived ideas and assumptions, limiting the output of the conceptual design) (McDonagh, Bruseberg & Haslam, 2002: 232).

Connection – In this phase, the designers were encouraged to connect with the user by recalling explicitly upon their own memories and experiences to reflect and understand. Designers establish a connection with the user on an emotional level by recalling their own feelings and

resonating with the user's experiences. At this phase, both affective and cognitive components are important: the affective to help understand feelings, the cognitive to understand meanings. McDonagh *et al.* (2002) have also observed that empathy leads to a connection of designers to users so they can effectively create.

Detachment – Designers must leave the user's world and design with user perspective. The designers detach from their emotional connection in order to get “in the helpful mode” with increased understanding. The designer steps back into the role of designer having made sense of the user's. By stepping out to reflect, one can deploy new insights for ideation. During these phases, the design team made paper prototypes to be used as products during the expressive user persona (role-playing). Prototyping through empathetic participatory design supports the idea that meanings and values need to be placed centre stage when addressing complex problems (McIntyre-Mills, 2010; Fila & Hess, 2015).

7.2.1 Concept Modeling Using Expressive User Personae: Lessons From Empathetic Participatory Design

Paper prototypes were used as artefacts during expressive user persona in an empathetic participatory design process. Expressive user persona (EUP) is a form of role-play where the participants mimic or mirror real-life events and activities as they happen in societies and communities. Buchenau and Suri (2000), from the design company IDEO, used a similar concept called experience prototypes. They conceptualized it as “any kind of representation, in any medium that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing” (p. 424). I argue that EUP offers low-fidelity and middle-fidelity prototyping for understanding existing user experience, exploring and evaluating a system being designed and communicating design ideas. During analysis, this is a reflective tool that can be used to review a user experience in the event that the participants cannot be called back for an in-depth observation. This is because in normal design research processes, there is research, documentation and design, implying that numerous observations are susceptible to loss or being misunderstood (Oulasvirta *et al.* 2003).

Though there are several modelling tools like the Unified Modelling Language, Entity Relationship Diagrams and flow charts, these are inadequate for socio-technical complex system designs among marginalised communities whose literacy and digital literacy levels might be low (Müller & Thoring, 2012). Expressive user personae are strong prototyping and modelling tools unknown to many system designers (Müller & Thoring, 2012). They offer alternative methods for research, communication, education and entertainment. Under this objective, the co-design team evaluated the designed paper prototype using the repertory grid technique from an empathetic perspective.

It was thus revealed that empathy requires us to put aside our learning, culture, knowledge, opinions, and worldview purposefully in order to understand other peoples' experiences deeply and meaningfully. It requires a strong sense of imagination for us to see through another person's eyes. It requires humility so we can seek to abandon our own preconceived notions and biases. It requires that we have a heightened awareness of other peoples' needs, wants, motivations and goals.

7.2.2 Rapid Prototyping Using Repertory Grid Technique

This session divided the design team into four groups of seven members each. The groups developed their own prototypes from the scenarios provided (Chapter 8, Section 8.7). After group sessions and presentations at the plenary, the group's prototypes were QuickApp, APB App, FindMe App and UBus App (all of which are citizen reporting applications for fire, accidents, kidnapping and rural transport booking, respectively).

The objective of applying the repertory grid technique was to examine the cognitive evaluation constructs generated by the design team as a way of documenting the artefact evaluation criteria. The five phases of the Repertory Grid technique (selection, triading, laddering, rating and analysis) were learnt through participatory action learning, and are described below:

a) Selection

During each session, the design team members were asked to draw up the grid using the initial prototype set. Each person worked independently with the selected set of prototypes. These were

written on participant sheets. The element pool helped identify constructs from which other elements were later rated. A role list comprised of short sentences or phrases (one for each element) that described typical elements in a domain application being designed. Four different paper screen shots were designed.

b) Triading

This is the core aspect of eliciting constructs without introducing bias from the lead researcher. The selection of the three elements was random in nature to give each element an equal chance of selection and avoid bias. The design team members were asked to identify how two of the three examples are different from the third. No starting point was provided, but each was asked about the constructs that are important from their own perspective. The constructs generated by design team members allowed the researcher fresh perspective. One participant came up with a construct I had not thought of at all. She said: *“This prototype allows the user to create a password if one did not have it but the other two prototypes do not have this option”*. This phase is critical because it uncovers the knowledge bases as constructs important to the designers.

Once the design member identified a construct, or how two prototypes are different from the third, then he or she was asked to name the polar opposites of the construct, and write the poles at the opposite ends of a row in the grid. Table 38 depicts a sample grid filled by one of the co-designers.

Table 38: Sample Repertory Grid

Construct	Elements			Contrast
	ReportIt App (A)	QuickApp (B)	FindMe App (C)	
Colourful	3	5	5	Colourless
Consistent	3	5	5	Inconsistent
Fitting icon	5	5	3	Unsuitable icon
Lively images/visual appeal	1	4	5	Dull/no images/no visual appeal
Newsy	1	5	5	Quiet
Logical navigation	4	5	5	Illogical navigation
Complete	4	4	5	Incomplete
Multifunctional	1	5	5	Single function
Reliable	5	4	4	Unreliable
Total	21	37	42	

Rating scale 1-5 (1-least rated and 5-Most rated)

This is an example of supplementary notes of the design team:

The ReportIt App system does not have any images or visual appeal compared to QuickApp and FindMe. It can be redesigned to include an interface with lively pictures that would allow a user to choose between the options more efficiently.

The co-designers continued the process of triading the prototypes to identify additional constructs. They were encouraged to identify and change which two examples are alike and which are different for the constructs. The point was to elicit as many constructs as possible, without any suggestions from the lead researcher/facilitator. However, during this process, the researcher encouraged interaction among the participants to share knowledge and shape their naming. Design team members were encouraged to seek consultations from the lead designer and researcher to give prompts in regard to giving names to describing their constructs elicited. They were also encouraged share their opinions with other team members. So sharing knowledge at this point resulted in the refinement of the elicited constructs and led to consonance, convergence and an expectation-confirmation state. To ensure that participants were actively engaged, the lead facilitator asked probing questions that encouraged them to think aloud but avoiding hints for constructs to minimize bias.

At this point, the participants exhibited motivation and zeal to learn the abstract concepts of triading and randomness and the facilitator was fascinated by the energy and empowerment the participants showed during this stage. The participatory room was full of vigour, movement and a sense of excitement among the participants. The way they elicited constructs was very interesting since they did not refer to any reading material during construct naming. This was a clear indication that users who possess tacit knowledge and may possess explicit knowledge as well may be brought into the design space to work with the designer who already has a wealth of both types of knowledge. Whereas Cook and Brown (1999: 385) believe that “tacit knowledge cannot be turned into explicit knowledge, nor can explicit knowledge be turned into tacit”, I argue that the two forms of knowledge are reciprocal during the process of participatory design.

c) Rating and Laddering

Each participant was asked to rate the constructs elicited on a seven-point Likert scale (one being the least important and seven the most). Likert scales are well established during construct elicitation and the length depends on a researcher's choice and research objective (Kelly, 1955; Adams-Webber, 1981; Landfield & Cannell, 1988; Gordon & Meyer, 2002). This study follows Kelly's original idea (1955) that RepGrid offers explanations for the relationships within the grid by formulating consequent propositions. Laddering, a technique within the RepGrid, was used to make detailed explanatory arguments in reference to the elicited constructs (Fransella, Bell & Bannister, 2002). It is a key technique within the co-design process and process of theorizing using abductive and retroductive inference. The laddering technique was corroborated with question prompts and clues to give design team members opportunity to deliberate among themselves.

d) Analysis

The results of the Repertory Grid were analysed both quantitatively and qualitatively using Atlas Ti qualitative data analysis software. Notes and descriptors of the constructs provided by the co-designers' own knowledge bases from triading were assessed to examine their understanding, knowledge and language. The participants, through participatory action learning, developed a 'factor tree analysis' or 'dendrograms' to cluster design elements, their constructs and rating outcomes. This allows for the ranking of the prototypes. Figure 29 is an example of factor tree analysis.

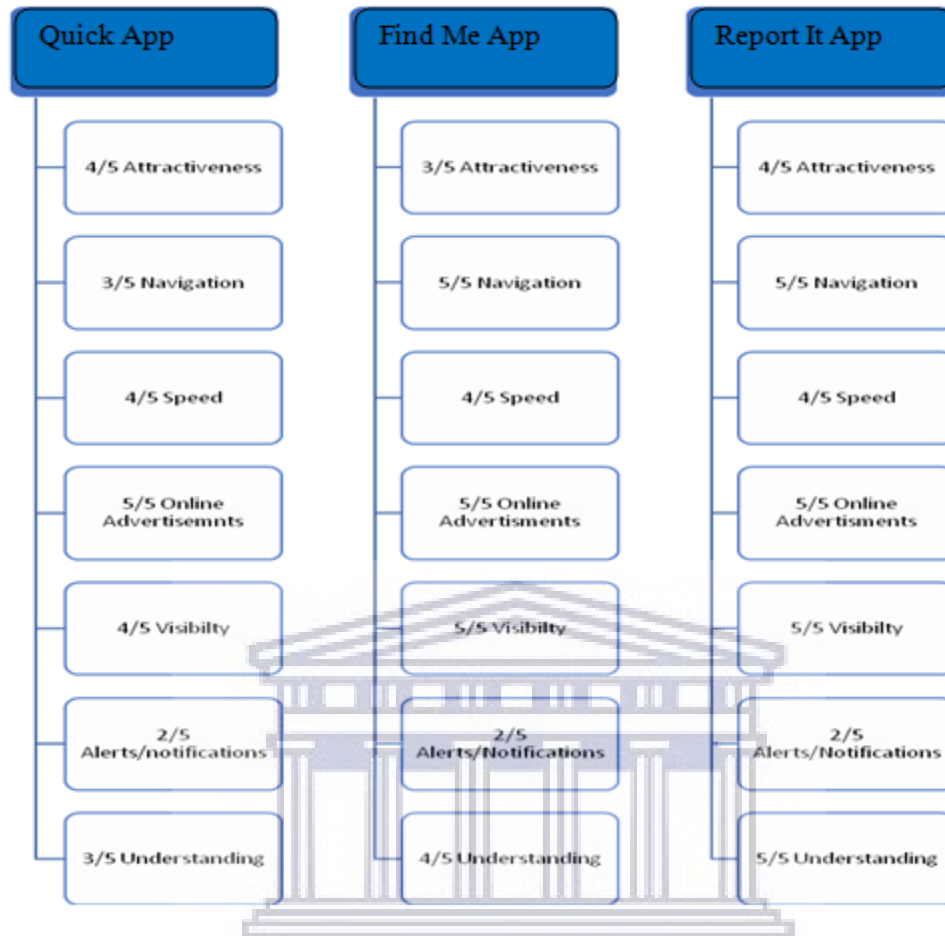


Figure 27: Factor Tree Analysis Figure

The elicited constructs were then coded using Atlas Ti to generate a network output document table. After analysis of all 28 participants' results, 132 open codes were generated (Table 38). Other Atlas Ti outputs and word clouds are in Appendix 14, page 388.

e) Output Document Table from Atlas Ti (Artefact Evaluation Using the Paper Prototypes)

Table 39 below shows open coded constructs generated from the design team members during the empathetic user-experiencing phase of the study.

Table 39: Output Document Table from Atlas Ti

Constructs generated	Totals	Constructs generated	Totals
Accessibility	14	Realistic design	1
Affordability	2	Relevant	10
App navigation	1	Reliability	3
Appealing colours	4	Security	5
Attractiveness	4	Sign in process	3
Authentication	1	Sophistication	1
Capability	1	Speak and video tools	2
Dynamic motion	1	Speed	8
Easy to create an account	2	Time sharing	1
Easy to use	12	Understandability	1
Fast capability	1	Usability	1
Fast capacity	1	Usefulness	2
Flexibility	1	User confidence	2
Instant	1	User friendly	6
Interoperability	3	User interface	1
Learnable	5	Utility	3
Media sharing	4	Verification	1
Precision	1	Totals	132

Figure 30 presents the results of the word cloud to aid the visualisation of the above quantitative results:

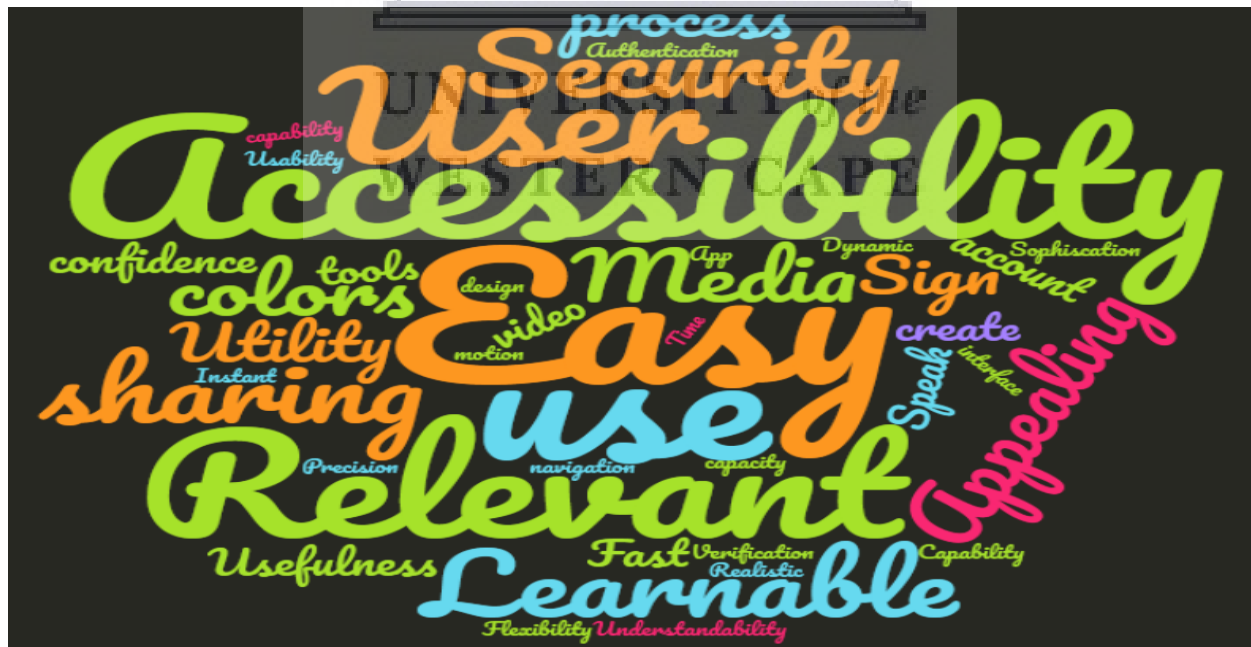


Figure 28: Construct Word Cloud

The results reveal that accessibility (defined in terms of ability to obtain the application and ease of navigation through interfaces) was ranked as the first construct to assess a given prototype. This was followed by ease of use (12/132) and relevance (10/132). The results are consistent with the survey data from SME owners gathering that yielded similar constructs.

Human beings construct varied meanings as they engage with the world they are interpreting. The lessons from the repertory grid method process render support to Easterby-Smith *et al.* (2008) who opine that human action is a response to the sense-making of different situations, not as a direct response to external stimuli. Personal construct theory and the repertory grid provides a fundamental framework for acquisition of knowledge aimed at measuring attitude, personality and engaging in cognitive mapping of varied situations and contexts (Klapper, 2011). I therefore continue to frame the analysis results into the situation awareness user-experiencing tool proposed for the study from a cognitive point of view under core code families as follows: perception, comprehension and project (also referred to as *cognitive mapping*) (Rosli, 2015). These determine the decision and, later, action.

7.2.3 Key Lessons for Reflection Drawn from Empathetic Participatory

Design

The following are among the key lessons learnt from the participatory design process component reported under this section (Kyakulumbye, Pather & Jantjies, 2018; 2019; *Published results in EKMJ*).

a) Voices During Empathetic Participatory Design Process

As knowledge unfolds among the designers and users, there arises a sense of knowledge conflict or divergence and knowledge harmony or convergence. For instance, during convergence, the users' mental models are aligned with the designers' conceptual models. This empowers and motivates outcomes among the team members. There happens to be varying voices in design, reflections, conceptualizations, participation, realization and ideations. Other silent voices involve the fear of shy participants who do not want to say anything negative or seek support during the design process. The lead designer has to listen and reach out to the less active participants to examine what goes on around their design world and internally by having a one-on-one consultation. Open criticism needs to be mitigated as it stifles initiative and creativity

among adult learners. There is need to devise ways of listening to the unspoken words as the facilitator observes the constructs elicited and questions participant decisions.

b) Balance Between User Expectations, Insights, Needs and System Requirements

During empathetic participatory design, there exists conflict between system conceptualization and realisation. Reflecting on whose voice is heard during the design research process yields divergences and convergences. Some of the divergences emanated from user needs finding (mental models) activities and experiences, as opposed to process modelling for defining functional activities. Divergence could result in frustration that in turn results in convergence and a sense of “I see now”. This could further result in fruitful discussions about project boundary, clearly articulating differences between needs and requirements, significance of context and the importance of giving users an accurate idea of the project at hand.

c) Openness and Empathetic Participatory Design

Openness nurtures exchange of knowledge and possible practices. Openness can occur at difference phases of the design process: in project time (open knowledge exchange during participatory design process) and user time (open knowledge exchange after participatory design). Openness can be access to functionality (user experiencing) and to meaning. Openness involves sharing knowledge, prototypes, software, hardware or processes that can be comparative to sharing scientific information, during which it is necessary to build in existing knowledge and exchange.

d) Motivation for Participatory Design

To keep the design team members motivated throughout the design process, I developed a theory of change I dubbed the co-design theory of change. This framework establishes that psychological empowerment (Zimmerman, 1988) is enhanced as a motivating factor especially among the underserved and unserved citizens (marginalised citizens). This is because this category of participants is in a digital divide that may be perceptual or real. It is an awareness that one cannot be part of the co-design process. It is this behavioural thinking that puts actors in a state of dissonance (inconsistent thoughts). The researcher set on-going training and incentivizing mechanisms as motivators for the co-design participants. Such trainings were

aimed at enhancing the capabilities and functioning (Sen, 2005) of the participants, ensuring project sustainability. The next section reports modelling the constructs into cognitive mapping design model.

7.2.4 Concept Modeling Using Cognitive Psychology Constructs

Though these concepts were explored using the Personal Constructs Theory, the construct categorisation aimed to generate a user-centric framework that must be mapped onto human information processing models. One such applied model is the Situation Awareness Theory by Endsley (1995). The next step in the artefact evaluation process draws from a cognitive psychology (situation awareness) framework that comprises perception, comprehension, projection, decision and action (Endsley, 1995; Rosli, 2015). It was assumed that perception, comprehension and projection result in an action outcome that is driven by participatory action learning. Situation aware design is one of the most feasible approaches for user-centred design (Endsley, 2016). The next section reports the results developed from Atlas Ti analysis using situation awareness theoretical lens.

a) Design Perception Network

Users perceive useful information from cues in the environment. Stored knowledge in a user's long-term memory helps them classify perceived information into meaningful representations. This information is called attention-based selection on task requirements and perceived information. Such information matches with stored information and is always ready to be retrieved by users as a basis for awareness. A user would perceive elements such as applications, interfaces, web pages, computer screens with their relevant characteristics (constructs) like colour, text size, sign-in processes, affordances (showing how a system can be used) among others.

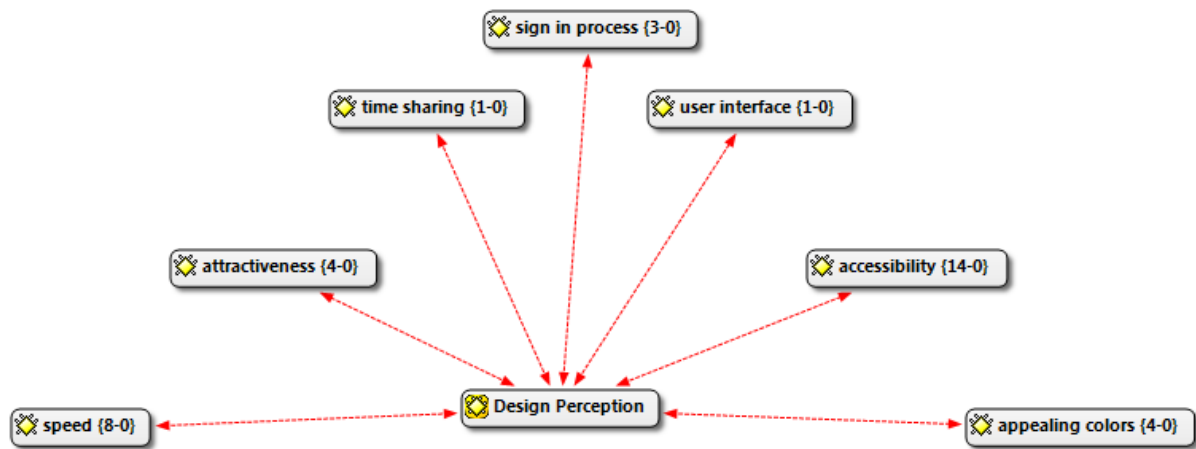


Figure 29: Design Perception Code Family and Open Code Constructs

The first step in achieving situation awareness is to perceive the status, attributes and dynamics of relevant elements in the environment (Endsley, 2016). They can be related to artefact characteristics like colour, size of icons, response speed and time, and icon locations. The perceived information matches the stored information in user's long-term memory and is retrieved by users as a basis for user awareness. From the network diagram of perception, we can observe that the most prominent construct generated by the co-designers was accessibility. Accessibility refers to a requirement that artefact content be structured in a way that a screen reader can interpret it; images need to include alternative text links and links need to have clear, meaningful labels (Tomlinson, 2016). Other perception constructs included speed at which the interface loads, appealing colours, time sharing, sign-in process and attractiveness. Like in Figure 30, the "Personal Information" text could hint to the required fields for the sign-up of an account. While the design team members understood the information displayed by the artefact interfaces, it was determined that understanding from the illiterate citizens' viewpoint was going to be problematic. The language used had to be translated to a local one that an ordinary citizen would understand. Moreover, shorter instructions incorporated in the interface are easier to understand.

b) Design Comprehension Network

Users organise and understand the significance of the perceived information on a particular situation. At this level, users organise and understand the significance of perceived information on a particular situation. With meaningful interpretation, users are able to create a mental model stored in their long-term memory. It is all about connecting what is visible now to what could have happened before. That is why there is need for users to have prior experience if this cognitive mapping is to occur. The constructs may include relevance, ease of use, understandability, affordability (both perceived and associated) and learnability among others, as illustrated in Figure 32.

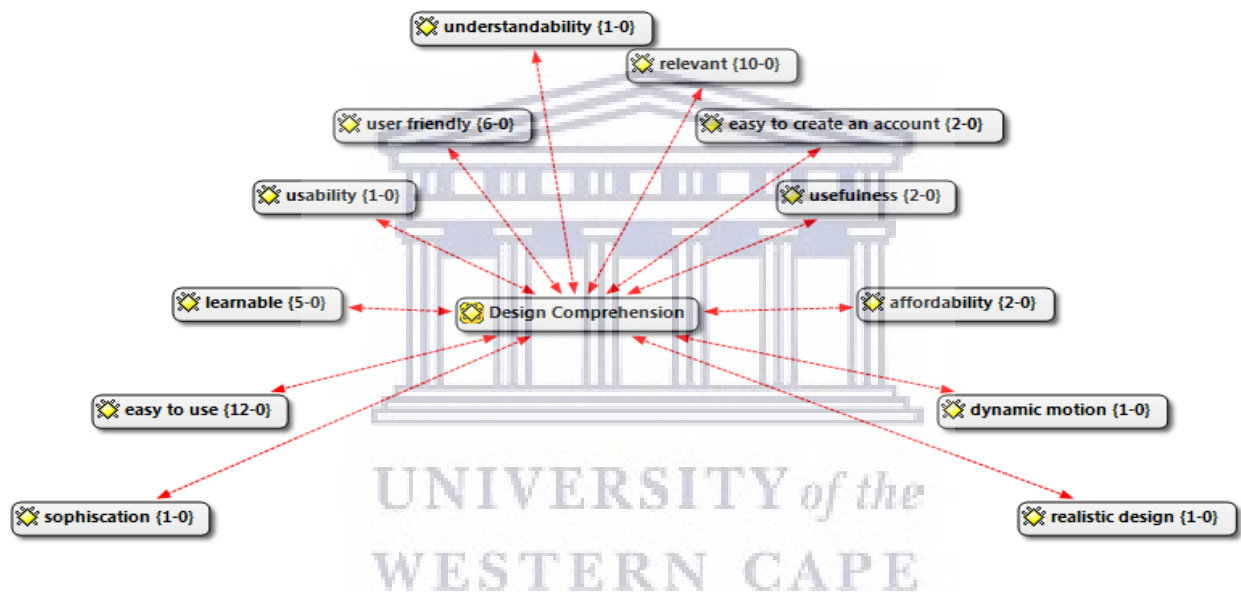


Figure 30: Design Comprehension Code Family and Open Code Constructs

A system that is easy to use should provide functions that are general so that such a system is applicable for users of all levels (novices, intermediate and expert users).



Figure 31: Comprehension System Characteristics

Some highlighted comprehension constructs displayed in Figure 33 were easy-to-use, user-friendly and relevant. Co-design team members were of the opinion that sharing information using WhatsApp was more relevant as most of them had used such a service before. However, when it came to reporting location of incidence, it was observed that such use was not user-friendly as not many co-design team members had used GPS, a challenge that was anticipated for typical citizen users as well.

c) Design Projection Network Diagram

At the projection level, users gain knowledge of the status and the dynamics of the elements. The users receive insight into probable solutions for future states of the system. Design feedback and error detection functions form part of this cognitive criteria. This is demonstrated in Figure 34.

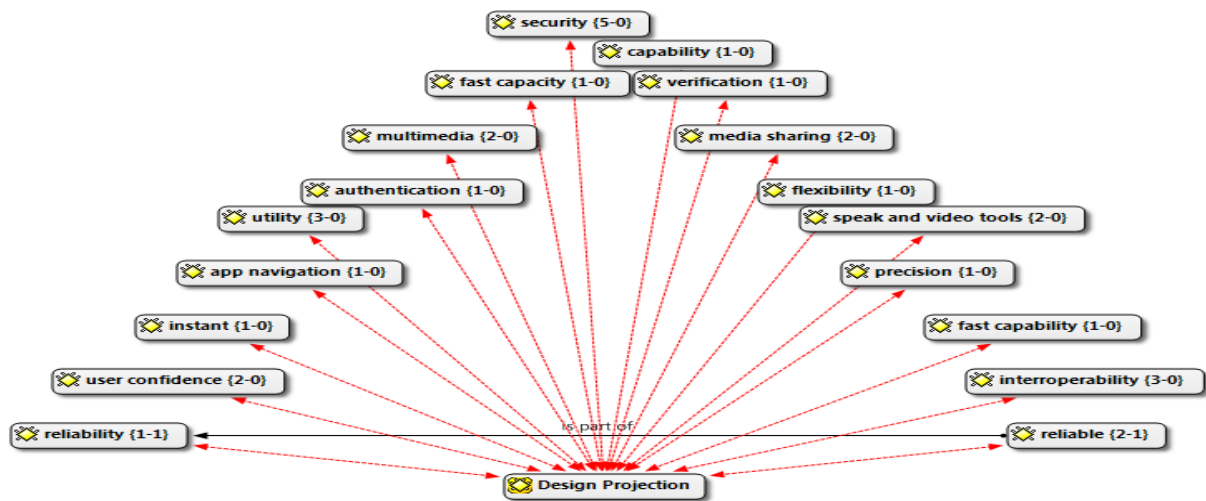


Figure 32: Design Projection Code Family and Open Code Constructs

The open and family codes are subject to alternative naming based on the different ways of naming, the theoretical lenses used and the background of the researcher and designers. However, the approach is feasible for any researcher undertaking empathetic user experiencing design. From the network diagram, speech and video tools, multimedia, media sharing and security features were deemed crucial projection constructs. The results of this study render support to Rosli (2015) who observes that feedback, guidelines, solutions, short notes, pop-up messages as well as audio and video prompts help users quickly analyse their next steps within the system.

7.2.5 Towards a More Refined Participatory Design Framework

The foregoing findings provide the basis for a model for application empathetic design (Figure 40) that describes how knowledge creation unfolds among co-design teams, thereby enriching the design outcome of the application using paper prototyping and the repertory grid technique. Design iterations result in dialogic interaction and participatory learning processes that may be formal or informal. This in turn helps realign the expectations and experiences of both the designers and the users. Though the foregoing attitude and belief constructs were six (benefit expectations, ICT learnability, ICT support, ease of use, user friendliness, user confidence), they explained for 17,6% of usage intentions – the remaining 82,4% remained unrevealed (contextual

factors). From the empathetic design process described in this Chapter, 132 similar constructs (See Table 37) were named based on the Personal Constructs Theory.

Below is an updated e-government for marginalised citizens participatory design model (Figure 35), empirically developed from empathetic participatory design, phase two during the high-fidelity prototyping and updated from Chapter Four, Section 4.10. This model forms the basis for testing the participatory design model during the user-experiencing phase.

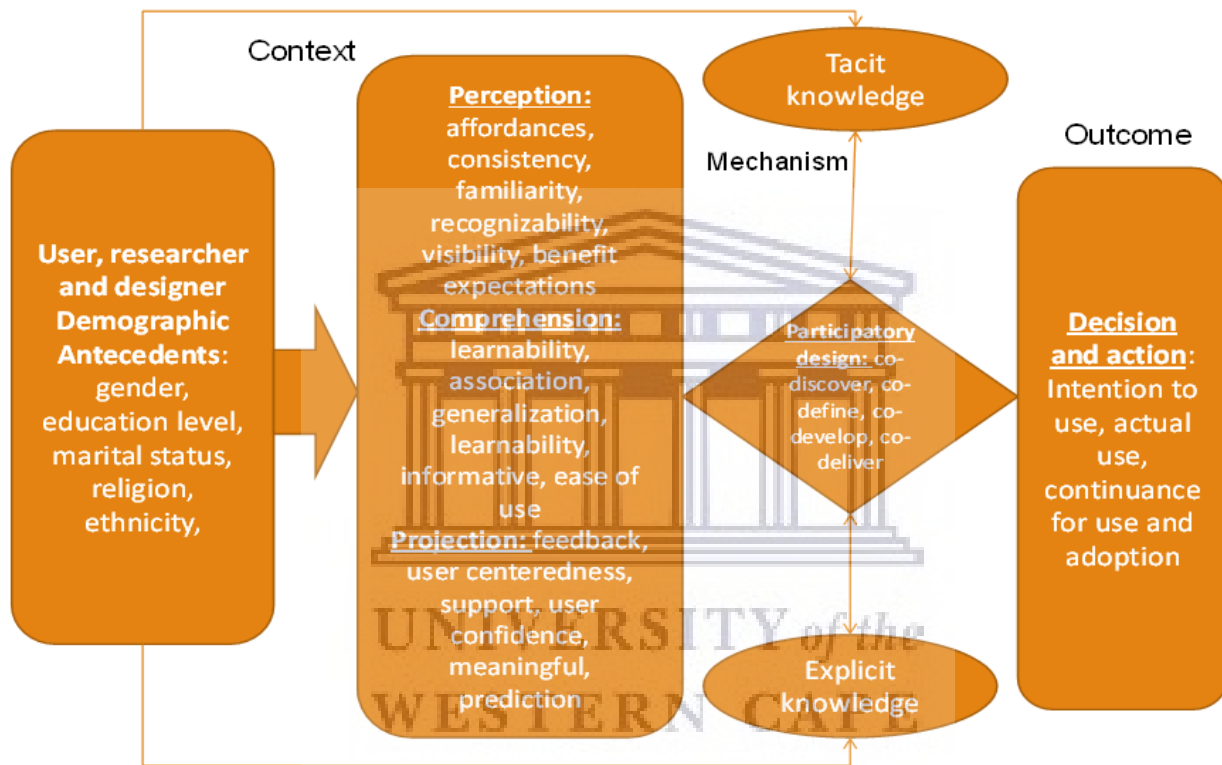


Figure 33: Updated Participatory Design Model

The participatory design theoretical framework in Figure 34 was directed at the behaviour of target users. This target behaviour may be non-use of e-services or e-government applications. This then implies that target behaviour change becomes the underlying goal of the design process. However, in order to start working easily with the user, the design conceptual models need to meet with the user mental models through switching ontologies. Key determinants of target behaviours are the pre-usage beliefs and pre-usage attitudes that must be established at the onset of the participatory design process. The target behaviour and those beliefs and attitudes can

be understood through user profiles' spoken and unspoken words and observed and unobserved behaviours. As beliefs and attitudes that govern behaviour are discovered, there is need for artefacts and prototypes to examine short-term user memory of perception, comprehension and projection. These are also termed cognitive criteria or mental models that result in long-term memory. The cognitive criteria, from a design point of view, can be categorized as functional, non-functional and contextual requirements upon which feedback has to be sought from users in a dialectic manner through a reciprocation of tacit and explicit knowledge. The results were based on causal inference aimed at understanding how designers interpret the design artefacts in an empathetic manner. This section reports results using statistical inference to strengthen the causal inference using descriptive and inferential statistics. However, with the use of statistics like regression analysis, a scientist can control the effects that govern real-life phenomena, and describe the relation between the observations. Moreover, the scientist endeavours to identify situations in which it is possible to observe the activity of a mechanism (Ron, 2002).

7.3 Artefact Evaluation Using Statistical Inference for Empathetic

Participatory Design Data

The results reported in this chapter are the use of a quantitative usability experiencing tool developed from the repertory grid cognitive evaluation from an empathetic point of view among the co-design team members' artefact evaluation (reported in the sections that follow); and later during the field testing using in-depth face-to-face interviews and observations (reported in Chapter Ten). The methodological details of the interviews and observations are described in the methodology chapters (Chapters Five and Six).

The presentation of outcomes starts with the quantitative evaluation results where 28 co-design team members switched roles as users and designers. Each respondent had to fill three structured questionnaires (Appendix 8, page 358). This tool, if used by another design team, may be validated based on context of use. The objective of the usability-experiencing tool was to support the use application of statistical models, not necessarily so that such models approximate a universal law of generalization. Instead, the use of statistical inference was to demonstrate the activity of the mechanism generated during the empathetic participatory design process and to produce evidence of an otherwise hidden mechanism. It was developed from the refined

participatory design framework (reported in 9.1.5) using the Situation Awareness Theory as a theoretical lens.

7.3.1 Co-Design Team Demographics (Context)

During the empathetic participatory design process, all the 28 co-design team members, each responded to 3 prototypes during the evaluation process. Below are the demographics where each co-design empathized a user in the three prototype evaluation process:

Table 40: Co-design team's demographics

Gender				Age			
		Frequency	Percent		Years	Frequency	Percent
Valid	Rather not say	3	10.7	Valid	20	3	10.7
	Female	11	39.3		21	10	35.7
	Male	14	50.0		22	4	14.3
	Total	28	100.0		23	2	7.1
Marital status					24	6	21.4
		Frequency	Percent		26	2	7.1
Valid	Married	6	21.4		28	1	3.6
	Single	22	78.6	Total	28		100.0
	Total	28	100.0				

From the above results, 39.3% of the co-design team members were female, 10.7% declined to mention their gender and 50% were males. As regards marital status, 78.6% were single while 21.4% were married. Regarding age, 100% of the co-design team members were below the age of 30 years. Such demographics could influence prior use of ICT since it was anticipated that e-government co-design success could be influenced by prior knowledge of ICTs. Below are the results for whether co-design team members has ever got involved in a co-design process:

Table 41: Prior involvement into co-design

Ever been involved in co-design					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	24	85.7	85.7	85.7
	Yes	4	14.3	14.3	100.0
	Total	28	100.0	100.0	

From the above results, it can be revealed that 85.7% of the co-design team members had never got involved in a co-design process while only 14.3% had ever been involved in a co-design process. It was also anticipated that prior involvement into a co-design process could result into variations into the co-design process being reported. Moreover, the study sought to establish whether prototypes had been equitably evaluated by the co-design team members and below is the results:

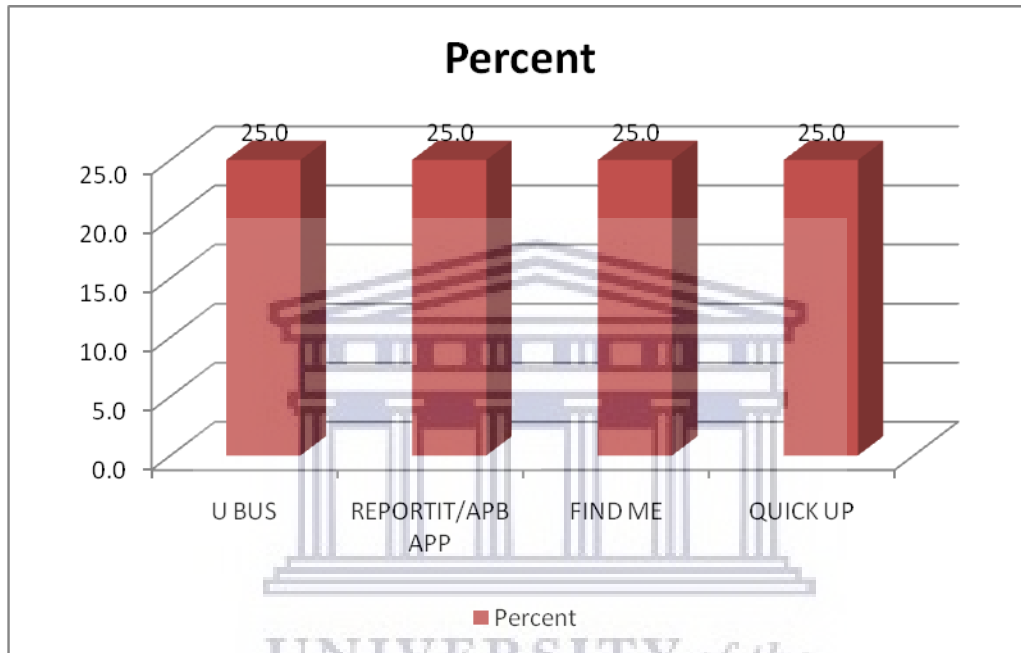


Figure 34: Response by prototype evaluated

The results reveal that the prototypes were equally evaluated by the co-design members. However, since they were four groups, a member of a group was not supposed to evaluate his/her own design. It was appreciated and evaluated by the other three groups that were not involved in the design. After the background characteristics of the co-design team members, below are the descriptive statistics from all the prototypes based on the situation awareness theoretical guiding model.

7.3.2 Co-Design Team Process Descriptive Results (mechanisms)

During the empathetic participatory design process, it was reported that the co-design team members took on the role of the users. This team acted as investigators in the co-problem discovery and scoping phases with selected citizen groups. The remainder of this section presents

the results from the quantitative usability-experiencing tool designed from the situation awareness cognitive criteria and mechanisms with evaluation involving simulation of prototypes (QuickApp, ReportIt, FindMe and UBus respectively) interfaces as illustrated Figures 37 below:

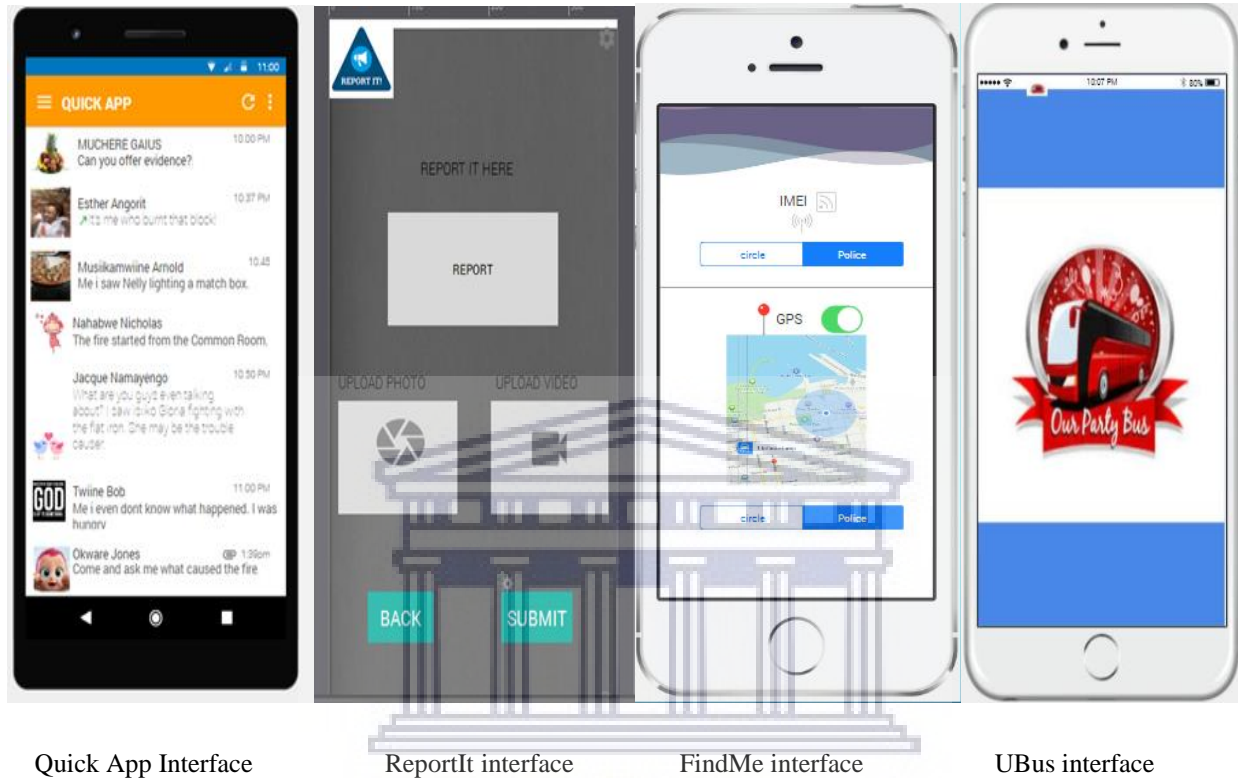


Figure 35: Sample Designed Mobile App Interface

Figures 36 provides a snapshot interface of the prototypes, which resulted into four different applications as potential e-government applications requested by citizens. Below are the descriptive statistics in table 42 of the evaluation of each artefact based on the co-designer's point of view for the *perception, comprehension and projection* constructs for the three artefacts (U-Bus, Quick App, ReportIt and FindMe App). The researcher used a Likert scale of 5=Strongly Agree, 4=Agree, 3=Not Sure and 4=Disagree, 5=Disagree. The following items were considered for each of the cognitive construct:

Table 42: Descriptive statistics of the Situation Awareness Constructs

Descriptive Statistics of perception situation awareness construct					
	N	Minimum	Maximum	Mean	Std. Deviation
Colors attracted my attention	84	1	5	3.15	1.294
Colors can be seen from a far	84	1	5	3.68	1.174
The icons are visible enough	84	1	5	3.56	1.112
The icons/pictures are understandable	84	1	5	3.73	1.022
Words are easy to understand	84	1	5	3.85	.912
I can easily recall information on the app	84	2	5	3.56	.827
The functions or parts are well intergrated	84	2	5	3.76	.816
Instructions are short enough and simple	84	1	5	3.70	.979
Information is easy to find	84	1	5	3.70	.967
The colors attracted my attention	84	1	5	3.17	1.230
Colors can even be seen from with naked eyes	84	1	5	3.70	1.106
The icons are visible enough	84	1	5	3.77	1.079
Valid N (listwise)	84				
Descriptive Statistics of comprehension situation awareness construct					
	N	Minimum	Maximum	Mean	Std. Deviation
The system is easy to use	84	1	5	3.58	.908
App can be easily used by novice users	84	1	5	3.29	.989
Labels are useful for novice users	84	1	5	3.68	.867
The information displayed on the system is easy to understand	84	2	5	3.82	.894
The system is easy to learn	84	1	5	3.74	.880
The system is informative	84	2	5	3.69	.918
Short notes offer quick guidance	84	1	5	3.55	1.023
It is easy to recall steps for working with this app	84	1	5	3.42	1.032
Valid N (listwise)	84				
Descriptive Statistics of projection situation awareness construct					
	N	Minimum	Maximum	Mean	Std. Deviation
The system seems safe to use it	84	1	5	3.71	.913
It is easy to use similar applications on other phones	84	1	5	3.46	1.103
App can guide me to give responses while using it	84	2	5	3.67	.948
It is easy to predict faults from this app	84	1	5	3.13	1.073
I can easily tell if the system is getting faulty	84	1	5	2.81	1.047
App has faulty message pop ups	84	1	5	2.93	1.128
Icons are not confusing	84	1	5	3.24	.926
Symbols and icons are a clear guidance for app navigation	84	2	5	3.57	.826
System feedback can guide subsequent actions	84	1	5	3.44	1.045
System guidelines are available for next actions of using app	84	1	5	3.39	.944
Pop up messages of App offer guide to user	83	1	5	3.20	.947
System had options for auto correction and prompts	84	1	5	3.14	.984
Actions are prompted by short notes/hypertexts	84	1	5	3.11	1.030
System attracts user attention	84	1	5	3.42	1.100
System can be used smoothly without problems	84	1	5	3.45	1.046
As I intend to loose focus, the system has hints to guide me back	84	1	5	3.35	1.167
Valid N (listwise)	83				

From the results in the table above, N=84 because each of the 28 co-designers had three sets of questionnaires to evaluate the three prototypes. Generally, a mean of above 3 implies that all co-design team members appreciated the perception related design of the prototypes. From the results in the table above, N=84 the results are similar with means above 3 apart from the items of the projection situation awareness construct with trailing means below others viz: “*I can easily tell if the system is getting faulty*” and “*App has faulty message pop ups.*” This implies that such features need attention during the subsequent design iterations.

The above results reveal varied means implying that the team members had different rationales for evaluating the artefacts. The appreciations of the artefact functionalities and characteristics call for a more detailed assessment of whether designer profiles could influence such differences during a participatory design process.

7.3.3 Examining causal mechanisms with relevant statistical inference tests

I employed the quantitative paradigm that requires testing the data for normality to establish whether it warrants parametric or non-parametric tests. Table 43 presents the results of the normality tests. This was for review of various goodness-of-fit and distribution matching tests that can be applied to assess the functioning of the mechanism during the simulation processes (Horwood *et al.*, 2014). Such tests can be employed to determine if a sample (random or non-random) could belong to a hypothesized parent distribution and its underlying mechanisms (Downward, *et al.*, 2002).

Table 43: Tests of data normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
PERCEPTION	.087	83	.187	.976	83	.115
COMPREHENSION	.084	83	.200*	.978	83	.178
PROJECTION	.075	83	.200*	.977	83	.151
PAL	.078	83	.197	.977	83	.125

*This is a lower bound of the true significance.
^a Lilliefors significance correction.

The purpose of this test was to establish if it warranted use of non-parametric tests. For example, non-parametric techniques require researchers to transform their observations of statistical

phenomena such that they can be articulated and measured either along nominal or classificatory scales, or ordinal or ranking scales. Such non-parametric tests may also be useful throughout the process of formulating and assessing the reliability of knowledge claims in the form of causal explanations (Finch & McMaster, 2000).

The results of the Shapiro-Wilk for small samples as shown in Table 38 reveal a p-value=0.115 for perception; p=0.178 for comprehension, p=0.151 for projection and p=0.125 for participatory action learning (PAL) which are not significant at a 95% significant level. The results of the data imply that the mechanisms operating among co-design members were not different. This warranted the use of non-parametric tests. The following section examines the reliability of the constructs measuring the various latent variables of perception, comprehension, projection and participatory action learning in table 44.

Table 44: Cronbach’s Alpha Results for Reliability Check

Latent variable	Number of observable variables	Cronbach’s Alpha
Perception	12	0.844
Comprehension	10	0.758
Projection	14	0.777
Participatory action learning	10	0.690
Total items in the tool used under this study	46	

Cronbach’s alpha is a measure of internal consistency in quantitative studies. An alpha of greater than 0.70 is considered to have acceptable reliability or internal consistence (Streiner, 2003). It is accepted that the higher the alpha, the better the value judgments of respondents. However, in this study, Cronbach alpha figures are for comparison of events and the quality of the generative mechanisms from the participatory design process (Smith & Johnston, 2014; Mohajan, 2017). Some studies have recommended thresholds as low as 0.60, 0.65 and above to be acceptable (Ives, Olson & Baroudi, 1983; Srinivasan, 1985; Todd & Benbasat, 1989; Moore & Benbasat, 1991). From the results, participatory design influences a co-designer’s situation awareness at varying degree. That is to say, participatory design process in this design context has an influence on perception by 84.4%; on comprehension by 75.8%; projection by 77.7% and participatory action learning occurs by 69%. To this study, all these thresholds are perceived as being above average if average scoer is set at 50%.

Whereas empericist studies recommend dropping constructs with low coefficients, the interrogation of reliability coefficients by way of dropping constructs with low reliability needs to be considered with content validity so that domain construct does not suffer (Moore & Benbasat, 1991). In fact, Nunnally researchers have argued that in early stages of research, reliabilities of 0.50 to 0.60 suffice, and that "for basic research, it can be argued that increasing reliabilities beyond 0.80 is often wasteful" (Nunnally, 1978; Bloch, 1981; Moore & Benbasat, 1991; Streiner, 2003).

Despite these debates, the measures herein assessed only measure constructs in the tool, but not reality since constructs are fictions and can be susceptible to error (Burton-Jones & Straub, 2004). Therefore, the results in this section were only used to examine the extent to which the co-design team members averagely scored the constructs during the artefact simulation process. The results imply that the team members had an observation consistence of 84.4% for the perception variable, 77.7% for projection, 75.8% for comprehension and 69% for participatory action learning from the simulation process. Wit, Heerwegh and Verhoeven (2014) used a similar construct reliability methodology in their study to examine whether openness for ICT and scientific research predict ICT skills and ICT use among undergrads.

Table 45 presents the Chi Square goodness-of-fit tests, the objective of which was to determine whether the results were generated by chance (Reder, 2008).

Table 45: Chi Square Goodness of Fit for Choice of Apps by Design Team Members

	Observed N	Prototype		Residual
		Expected N		
U BUS	21	21.0		.0
REPORTIT/APB APP	21	21.0		.0
FIND ME	21	21.0		.0
QUICK UP	21	21.0		.0
Total	84			

The above results reveal that, as all co-design team members chose the applications as expected, the number is equal to the observed number, displaying no difference between the observed and expected frequencies. Table 46 below reveals the test statistics.

Table 46: Test Statistics

Test Statistics		Prototype
Chi-Square		.286 ^a
Df		3
Asymp. Sig.		.963

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 21.0.

The obtained Chi-Square value has a p-value of .963: this is more than .05, and so our observed frequencies of choice of app based on functionality were not significantly different from what I would expect to get by chance. The next results reported reveal whether gender profiles influence the way a co-designer evaluates a given artefact of selection.

7.3.4 Influence of Gender Cco-Designer Profiles on Artefact Evaluation (context and mechanisms compared)

From literature, it was observed that the gender of a co-design participant influences design outcomes and artefact evaluation (Lilja & Ashby, 2001; Piller *et al.*, 2005; Brandt *et al.*, 2010; Malmborg *et al.*, 2016). At the time of study, the co-design team mainly differed in gender and age. They all had the same marital status, their livelihood means were the same (unemployed students still in university) and they all lacked dependants.

Table 47: Gender and Perception

	Chi-Square Tests		
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	90.583 ^a	56	.002
Likelihood Ratio	88.457	56	.004
Linear-by-Linear Association	10.302	1	.001
Number of Valid Cases	84		

a.87 cells (100.0%) have expected count less than 5. The minimum expected count is .11.

It is apparent in the table above that the Pearson Chi-Square is 90,583 and p=0,002. I used a Chi-Square test for independence to determine whether gender influences the cognitive criteria during evaluation of the four artefacts among co-design team members. This is because the inclusion of generative mechanisms at the psychological level makes it possible for researchers who are interested in understanding to engage in hypothesis testing and refinement (Smith, 2010). In this case, the researcher identifies the distinctive properties or characteristics of

generative mechanisms at work. When using gender as a distinctive property, the results reveal that the P-value (0,002) is less than the significance level (0.05), and the null hypothesis cannot be accepted. Thus, the researcher concludes that there is a relationship between gender property and cognitive evaluation of the co-design team members.

Table 48: Symmetric Measures

		Symmetric Measures Value	Approximate Significance
Nominal by	Phi	1.038	.002
Nominal	Cramer's V	.734	.002
N of Valid Cases		84	

Phi and Cramer's V presented in Table 48 above are both tests of the strength of association between the characteristics. The results Phi=0.002 and Cramer's V=0.002 reveal that there is a strong significant association between gender and cognitive criteria. Table 49 shows the effect of gender on comprehension cognitive criteria.

Table 49: Gender and Comprehension

	Chi-Square Tests		
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	47.432 ^a	42	.261
Likelihood Ratio	50.182	42	.181
Linear-by-Linear Association	6.407	1	.011
N of Valid Cases	84		

a. 66 cells (100.0%) have expected count less than 5. The minimum expected count is .11.

From Table 48 above, it is clear the Chi-Square value is 47.432 and p=0.261. I used a Chi-Square test for independence to determine whether gender is a related comprehension cognitive criterion of the four artefacts. The results reveal that the P-value (0,261) is more than the significance level (0.05). Therefore, the results uphold the null hypothesis that there is no significant effect of gender on comprehension cognitive criteria. Thus, the conclusion is that gender does not influence the comprehension cognitive evaluation of the co-design team members. Therefore, symmetric measures are not required.

Table 50: Gender and Projection

	Chi-Square Tests		
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	70.484 ^a	54	.065
Likelihood Ratio	73.058	54	.043
Linear-by-Linear Association	6.210	1	.013
N of Valid Cases	83		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .11.

The Chi-Square result is 70.484 and $p=0.065$. I used a chi-square test for independence to determine whether gender is related to the cognitive criteria of the four artefacts. The results reveal that the P-value (0.065) is more than the significance level (0.05). Therefore, the results uphold the null hypothesis that there is no significant effect of gender on projection cognitive criteria. Gender does not influence the projection cognitive evaluation of the co-design team members. Symmetric measures are not required.

7.3.5 Descriptive results of participatory action learning (outcome)

This study also questions if there is participatory action learning during the co-design process as an outcome. Below are the results in table 51:

Table 51: Descriptive Statistics for Participatory Action Learning

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
I gained a lot of knowledge during problem discovery.	84	2	5	3.92	.698
My knowledge and technology appreciation were from problem definition and scoping.	84	2	5	3.94	.766
The use of group discussion was most interesting on my side.	84	2	5	4.05	.863
I mostly enjoyed use of roleplay and action demos.	84	2	5	4.14	.697
The paper demonstrations let me learn the most.	84	1	5	4.02	.944
I liked the use of cartoons and stick pictures for personae.	84	2	5	3.85	.829
Cartoons and stick pictures were of the highest interest to me to learn about computer application use.	84	2	5	3.79	.906
Text drawings were well used and appealing to me.	84	1	5	3.93	.875
Hands-on computer practice for app design made me like computer use most.	84	4	5	4.48	.502
I would like to join this co-design exercise if given another opportunity.	84	4	5	4.54	.502
Valid N (listwise)	84				

From the above results, N=84 because each participant evaluated three (3) artefacts and submitted three questionnaires. The results further reveal that co-design team members gained knowledge during the participatory design process. The extent to which Participatory Action Learning (tacit and explicit) was influenced by cognitive criteria is presented.

7.3.6 Examining the extent to which PAL is explained by the situation awareness constructs

From the descriptive results, items that constitute a given construct (the three situation awareness constructs) were aggregated into a composite measure and ordinary least squares were used to examine the explanatory power of the outcome. Examining extent to which Participatory Action Learning (tacit and explicit) was influenced by cognitive criteria was through ordinary least squares and the model summary is presented in table 52 below.

Table 52: Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	.483 ^a	.233	.204	.34057	.000

a. Predictors: (Constant), Projection, Perception, Comprehension

From the model summary in Table 52 above, it is evident that 23.3% of variations in participatory action learning among co-design team members are influenced by the three cognitive information-processing criteria. There are still 76.7% of factors that could influence action user decision like usability and intention for use. Such factors and constructs are candidate issues for investigation during the participatory usability simulation design process with the typical citizens reported in the subsequent chapter. Archer *et al.* (2013: 328) argue that the R² (if given further explanatory power like “accounted for”, “had an influence”, “effects” and “is due to”) connotes casual efficacy in the realists’ sense, implying that causes bring about their effects. Moreover, such results point to hidden regularities that are not observed directly in an open system (Ron, 2002).

7.3.7 Theoretical modeling using the regression results

After establishing the coefficient of determination, the researcher used statistical inference to investigate the causal mechanisms during the participatory design process using regression coefficients and path modeling. Below are the results of the theoretical model in table 53.

Table 53: Regression Tests from the Empathetic Artefact Prototype Evaluation

Dependent variable	R ²	Independent variable	S.E. (b)	B (standardized coefficients)	t-statistic	Significant level
Perception	0.158	Constant			-0.001	0.999
		App (Artefact)	1.028	0.397	3.923	0.000**
Comprehension	0.031	Constant			1.439	0.154
		App	1.103	0.177	1.624	0.108
Projection	0.049	Constant			1.164	0.248
		App	1.087	0.222	2.050	0.044**
PAL	0.146	Constant			13.798	0.000
		Perception	0.369	0.382	3.746	0.000**
PAL	0.097	Constant			11.448	0.000
		Comprehension	0.380	0.312	2.973	0.004**
PAL	0.203	Constant			12.132	0.000
		Projection	0.343	0.450	4.536	0.000**
Adopt		Perception	Not tested for in this thesis			
Adopt		Projection	Not tested for in this thesis			
Adopt		PAL	Not tested for in this thesis			

The statistical significance of the model relationships can be tested using β values, the coefficient of determination (R^2), t-statistics or significant level values. However, the scientist undertaking a study using this model is at liberty to use the context variables as an explicit or implicit *ceteris paribus* condition and can generate other causal relationships as dictated by the context of design and artefact evaluation. The results path model is presented below in Figure 38 using the standardized coefficients and their respective significant values since the independent variables has different measures:

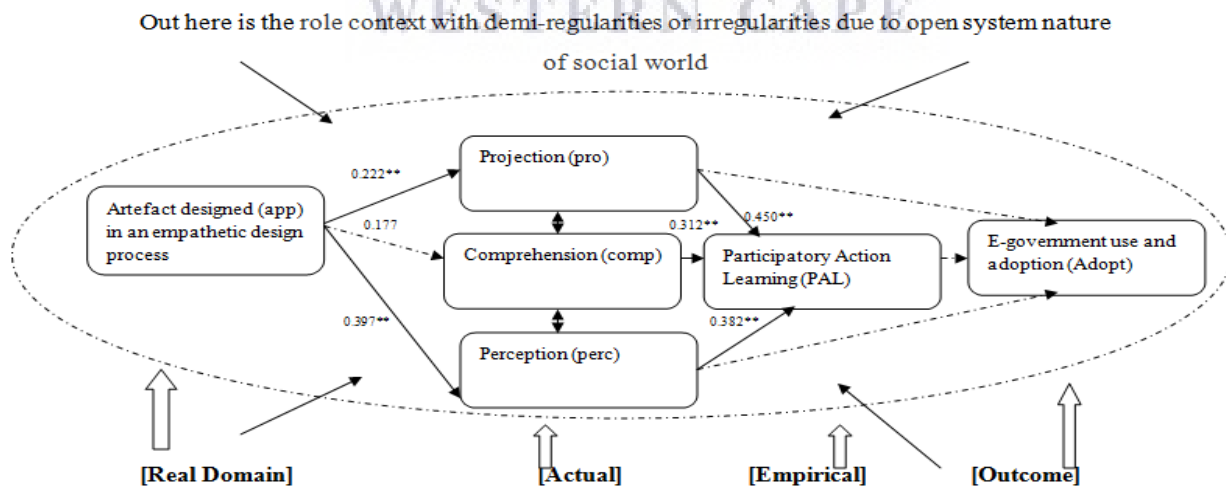


Figure 36: Theoretical Artefact Evaluation Path Model Results

The above model depicts how the designed e-government applications during an empathetic participatory design general causal mechanisms and how these can be well explained by statistical inference to determine outcomes. Single-headed arrows within the model represent directional causal mechanism relationships while double-headed arrows represent bi-directional casual mechanisms relationship. From the results, the co-designed artefact features have a causal-mechanism relationship to how they are perceived (sig.=0.397) and projected (sig.=0.222); with no significant causal relationship as to how they are understood (sig.=0.177). There is a significant causal interrelationship among the situation awareness constructs as observed from the results. Moreover, there is a significant casual relationship between perception and action (sig.=0.382), comprehension and action (sig.=0.312) and projection and action (sig.=0.450). The relationship between situation awareness constructs, PAL and e-government adoption are not tested in this study.

Figure 38 assumes a closed system during the empathetic design process that is not the case in practical environments. The upcoming chapter presents results from the citizen user experiences while simulating the designed artefacts in an open design environment. These were to corroborate the empathetic participants' artefact evaluation criteria while revealing other usability issues termed as context issues operating within an open systems design space.



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CHAPTER EIGHT

PHASE FOUR RESULTS: CITIZEN ARTEFACT USABILITY EXPERIENCING

““What users believe they know about a user interface (UI) strongly impacts how they use it,”
(Norman and Nielsen, 2010).

8.1 Introduction

As already observed, empathetic participatory design helps to get as close as possible to the world of the citizens regarding e-government implementation and to interpret this world and its problems from the inside in order to describe both the unique and typical experiences and events within this environment (Carlsson, 2005). Notwithstanding, it is revealed that what users believe they know about a user interface (UI) strongly impacts how they use it (Norman and Nielsen, 2010). Therefore after undertaking a quantitative in-house empathetic evaluation to familiarise the co-design team with our own and user’s perspectives about new systems, I prepared them for field usability experiencing (Appendix 9, page 363). Prior to this last task, the team went through drill exercises of “what if” scenarios (another exercise in empathizing) to prepare for the anticipated questions in the field. In addition, the research assistants were oriented to be as open and flexible as possible. The interview schedule had ten sections divided among the team. The interview guide is in Appendix 9, page 363 attached. The purpose of this phase was to the mechanisms that operated among the co-design team, align them with findings from citizen users, and investigate other contextual factors that account for other 76% of e-government usage intentions from the the statistical inference model as per the objective in the schedule below:

Table 54: Citizen usability design and research schedule

PHASE	Design and research objective	Design and research activities	Target population	Key outcome
DSR3	DO: To examine how the user can familiarise themselves with the application system under design. RQ: <i>To what extent can citizen situation awareness criteria align with the situation awareness criteria of the co-design team members?</i>	DA: Low, middle iterations drawn from DSR3 deemed necessary for community use based on given context and situations; interface simulations for users to logon, visualise, and ask questions	Representative community members but selected SMEs citizen owners under this study context Co-design team members as research	The presentations resulted in shortened prototype interfaces, merging some. Most prototypes were long with over 8 screens. Groups reduced them to 4 or 5. The users did not like the paper prototypes and instead requested real applications during testing. Context related issues were

RA: In-depth observations, interviews and face-to-face interviews	assistants	discovered in addition to the cognitive criteria generated during the empathetic participatory design process.
Develop stories that describe human activities or tasks		

8.2 Field Preparatory Phase

Each team of research assistants comprises interviewers, observers, note takers and support. Table 54 below indicates the name of the app, which was the subject of the interview, the number of members in the research team and the number of respondents interviewed:

Table 55: Usability Experiencing Co-Design Activity During Field Simulation

App Name	Number of interviewers	Number of interviewees
UBus	One group with 7 members	5
QuickApp	One group with 7 members	5
FindMe	One group with 7 members	5
ReportIt	One group with 7 members	5

The following were the steps of the field preparatory phase:

Step One (building rapport): Rapport has been a subject of studies in a variety of contexts and contextualized in many different ways (Gremier & Gwinner, 2008). In this usability study context, rapport refers to the communication characterised by warmth, enthusiasm and building citizen interest. This was to build the quality of the relationship between the co-design team and the citizen system user. The co-design team used attentive behaviour through focused eye contact, physical proximity and backchannel responses (e.g. head nods, ‘um-hmms’) and other nonverbal cues. Another behaviour engaged in was imitative behaviour, whereby citizen users matched the behaviour patterns of the co-design team during the simulation process. The co-design team observed the nonverbal and verbal cues. Such imitative behaviour was useful for citizens to feel at ease with co-designers and research assistants that were initially less familiar to them. Yet another behaviour was courteous behaviour, with the co-design team smiling, using congenial greetings, showing concern about the user and thanking the users for their patronage.

Step Two (digging deeper): This involved working with the users to find common ground. The users were guided through the simulation process to discover areas of similarity and mutual interest among themselves and the co-design members. The usefulness of the artefacts were assessed from the users' own perspectives resulting into the refinement of the interfaces and icons.

Step Three (capturing any alternative user needs): Needs are fundamental determinants of human behaviour (Van den Broeck *et al.*, 2008). This was a major cornerstone of the usability experiencing process postulating that human needs must be satisfied for individuals to flourish. Some of these needs were related to the artefacts themselves whilst others were from the users' perspective. This phase resulted in alignment of the artefacts with the identified needs.

Step Four (redefining the problem statement as and when necessary): The artefacts were designed. This usability-experiencing phase resulted in a re-examination of the problems the design applications were targeting. There was unanimous acceptance of the problems that were to be solved by the applications (fire, robbery, kidnap and hard-to-reach transport). This phase resulted in harmony and convergence, and any contradictions unclear to the user were addressed. Upon establishing that the users' needs were being met, the detailed usability simulation was commenced.

Through the use of high-fidelity prototypes, the research assistants, co-design team and lead researcher demonstrated the use of the application while allowing citizens hands-on experience with the designed interface applications. These were aligned to the pre-usage beliefs and attitudes that were generated during the status quo ICT investigation phase. The pre-usage beliefs and attitudes included: benefit expectation, learnability, ICT support, ease of use, cumbersomeness and user friendliness. More emerging issues were generated during the usability-experiencing process. The researcher grouped the emerging issues using Endsley's (1995) cognitive situation awareness theoretical lens as perception, comprehension and projection issues. In addition, other citizen profile contextual based issues not captured with Endsley's cognitive evaluation model were identified. These results are presented in the Table 56 below and detailed explanations are provided in the following sub-sections.

Table 56: Situation Awareness Cognitive Constructs

Super code based on situation awareness theory	Cognitive code family	Number of raw codes related to the code family
Perception	Accessibility	8
Perception	Affordability	4
Perception	Affordances	14
Perception	App Awareness	10
Perception	Chunking	3
Perception	Consistency	1
Perception	Navigable	1
Perception	Recognisability	1
Perception	Reliability	2
Perception	Visibility	13
Total codes for perception		56
Comprehension	Association	4
Comprehension	Compatibility	39
Comprehension	Complexity	4
Comprehension	Cumbersomeness	10
Comprehension	Ease of use	4
Comprehension	Efficiency	1
Comprehension	Familiarity	10
Comprehension	Learnability	6
Comprehension	Shareability	1
Comprehension	Understandability	12
Comprehension	Usefulness	15
Comprehension	User friendliness	12
Total codes for comprehension		118
Projection	Benefit expectation	1
Projection	Feedback	13
Projection	ICT support	2
Projection	Prediction	1
Projection	Privacy	2
Projection	Secure/security	5
Projection	Simultaneous-Use	1
Projection	Speedy response	3
Projection	User confidence	3
Total codes for projection		31
Context codes		
Citizen profiles issues	Citizen profile	11
Policy and legal framework	Policy context	5
Problem context	New problem context	3
Total codes for context		19

It is observed that a total of 224 raw codes were categorised into 35 code families and four super codes using the Atlas Ti coding scheme. These codes were generated from 25 citizen users while co-designing with 28 co-design team members with four artefacts. From each artefact, each citizen user generated 11 artefact features. Detailed explanations are provided in the following section. The usability experiencing phase has resulted in more enriched codes compared to the factor analysis pre-usage (pre-usage beliefs and attitudes) phase among citizens that yielded six (6) factors and the empathetic participatory design phase among co-designers, whose results yielded 132 codes.

8.2.1 Findings on Perception

Users perceive useful information from cues in the environment (Rosli, 2015). At each stage of the usability experiencing process, the prototype was improved based on inputs from the users. All users understood the information displayed on the applications at all stages. For example, citizens were with the view that UBus had a bus icon, QuickApp had yellow and red waves resembling fire and FindMe had icons for group invites and WhatsApp. Red color signals danger while yellow alerts people prepare for circumstances that could occur (Figure 39).

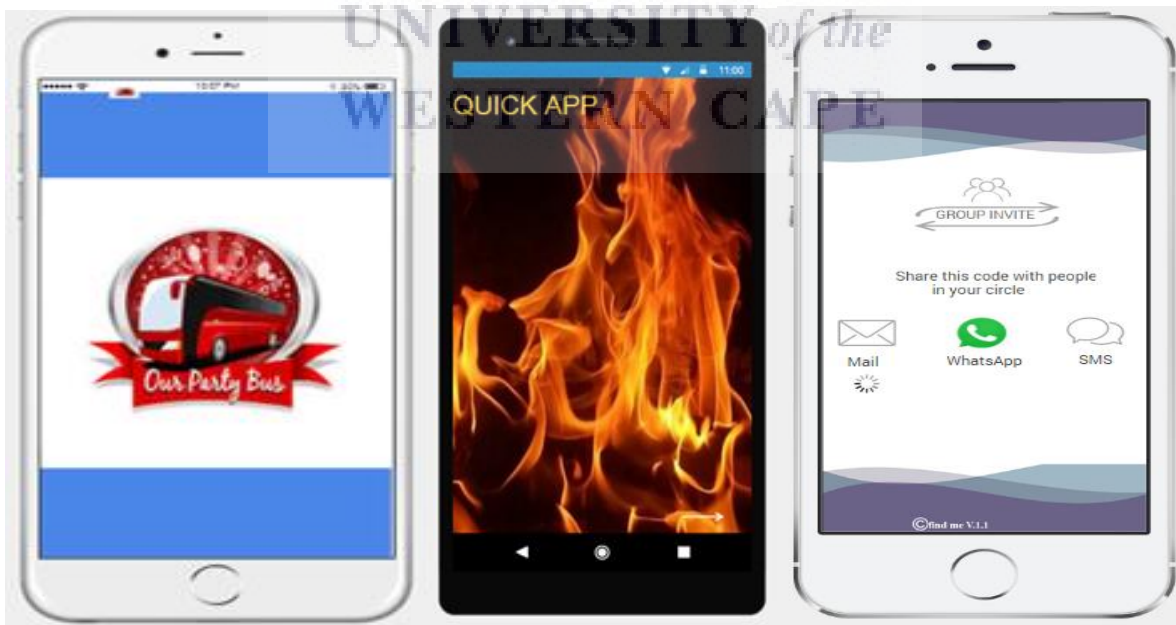


Figure 37: Application Visibility

Similar to visibility cognitive criteria, other perceptual code families included accessibility, affordability, affordances, application awareness, chunking, consistency, navigability, recognisability, reliability and visibility. The most prominent were affordances, awareness and visibility. Below are the network diagrams depicting the raw codes forming the most prevalent code families.

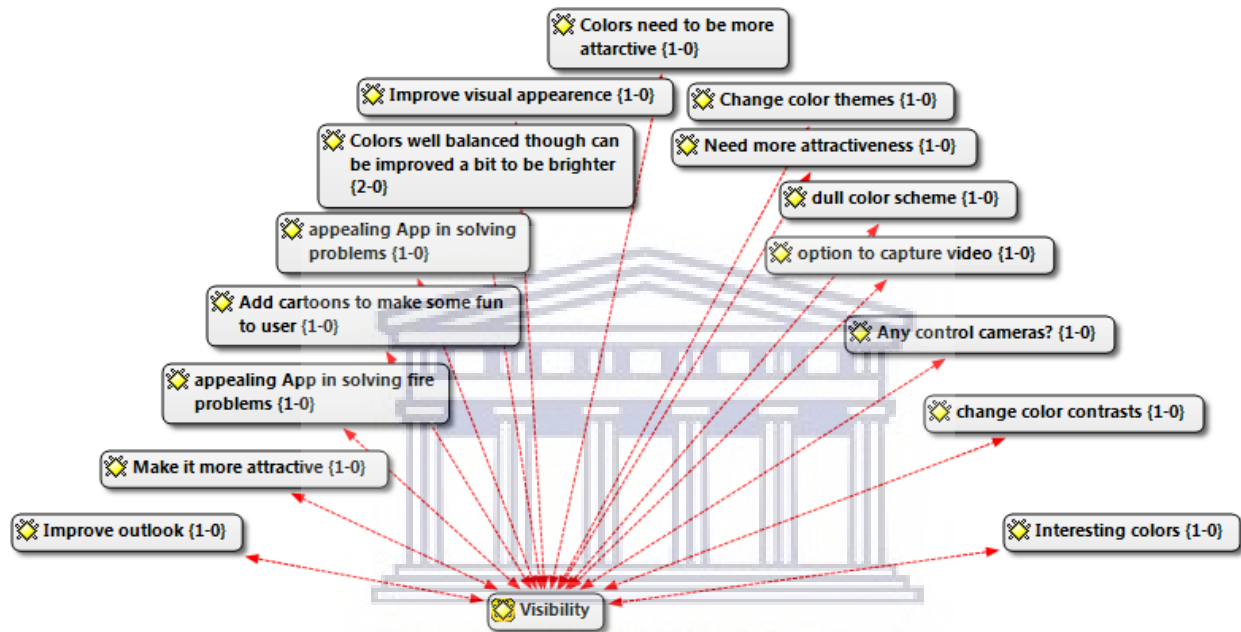


Figure 38: Visibility Network Perception Figure

Users’ visual issues were related to colours. Two users claimed that the interface colours were well balanced but needed to be brighter. One requested the addition of cartoon features to make some fun to use. Another suggested for a change of colour contrasts, and for the option to capture video and make interfaces more attractive.

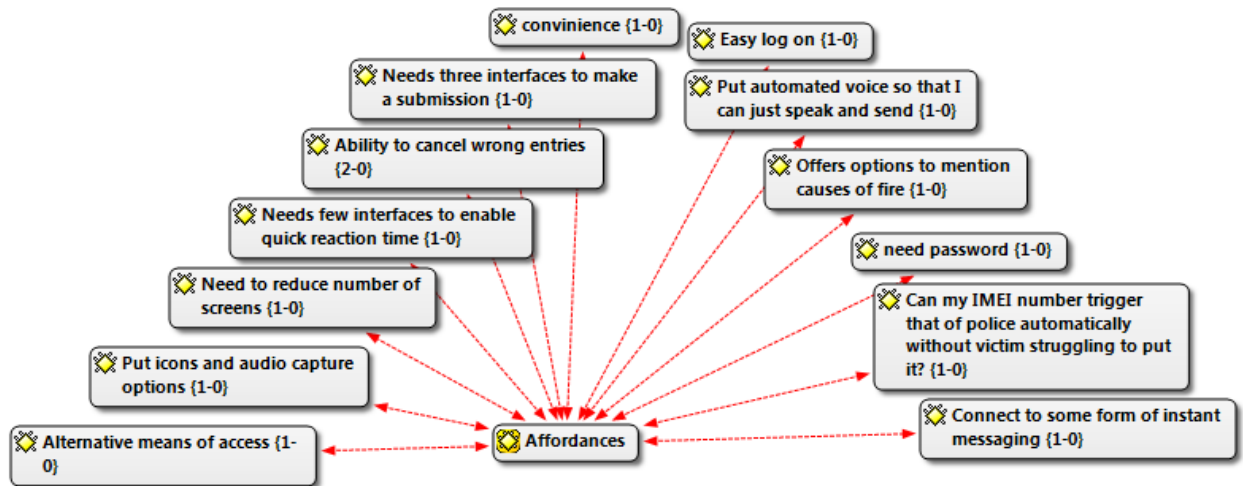


Figure 39: Affordances Network Figure

Affordances in the design aspect suggest how the artefact should be used, providing strong clues for the operation of systems.

8.2.2 Findings on Comprehension

There were thirteen codes related to comprehension and the most prevalent were compatibility, cumbersomeness, familiarity, understandability, usefulness and user friendliness. Compatibility generated 39 raw codes as per the quotation below:

[Catering for non-smart technology of the rural] [connection to GPS] [Device compatibility] [does it work both online and offline?] [Good you have linked it to other social media, big advantage] [GPS connection problem] [if I do not have an email address!] [integrating it with existing security options for crime, how?] [Internet availability] [Internet connection problem] [Less data then] [Limited access to smart phones] [Link it fire fighting companies and police brigade] [Linking to fire fighting companies] [More linkage with existing applications we have like e-bank services] [need for email?] [Needs to be used even when in offline mode] [No smart phone] [Only for smart phone users] [only works for users with email] [People without smart phones] [Phones without GPRS] [Reflection to link it to other social media] [Reliability calls for everyone to use regardless of type of phone device] [Should work all kinds of phones] [Sign in is with email which many of us do not have] [Smart phones availability] [Takes long to connect to another interface] (Quotation(s): 39)

Citizens were concerned with the lack of access to the internet that could threaten the compatibility of the developed e-government applications. Similarly, others were of the view that the lack of Smartphones would make them not use the developed e-government applications and called for applications that are compatible with all types of phones.

The quotations related to cumbersomeness are provided in the network diagram below.

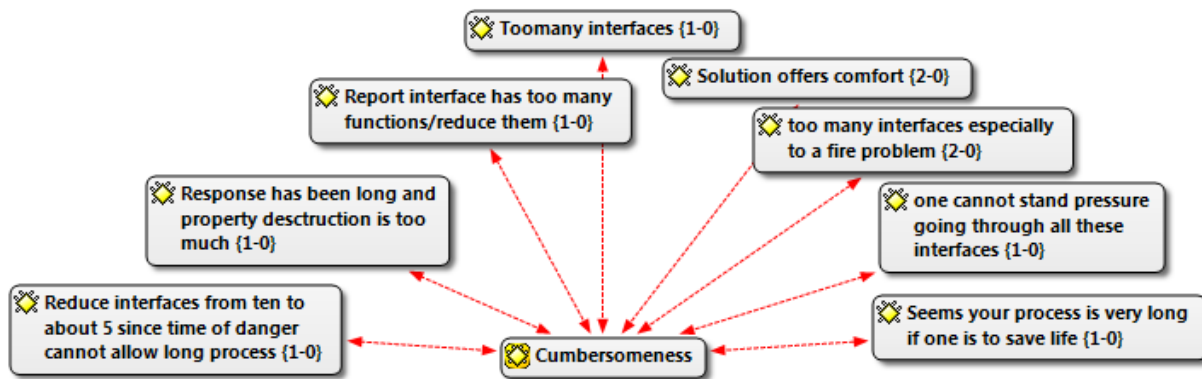


Figure 40: Network Diagram for Cumbersomeness Comprehension Criteria

It can be noted that the users thought that too many interfaces are cumbersome to use since situations like “danger” (fire, kidnap, theft) afforded long reporting processes. One user observed, “One cannot stand the pressure going through all these interfaces.”

Users need solutions that offer comfort, with interfaces as few as five (5) as opposed to some designs that had ten (10).

8.2.3 Findings on Projection

Integration of projection in design requires a system designer to develop a system that can provide users positive responses when using it. This builds user confidence and will help users analyse the problems and come up with possible solutions. The following code families were generated: benefit expectations, feedback, ICT support contexts, prediction, privacy, secure/security, simultaneous use and fast response. The most prevalent was feedback option with 13 raw codes, as observed in the network diagram below.

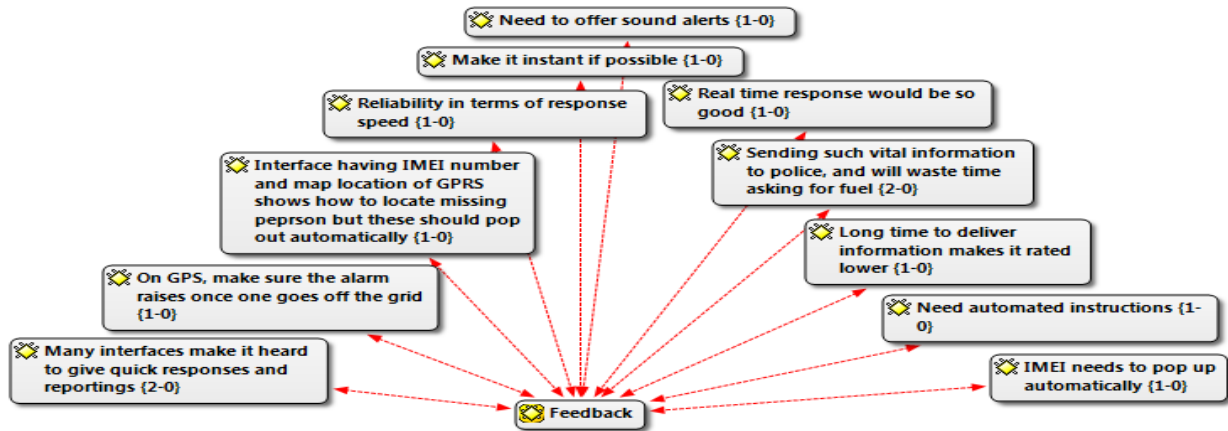


Figure 41: Feedback Projection Criteria

Themes relating to feedback include quick responses, need for alarms, automatic connection to GPRS, reliable responses, instant messaging, sound alerts, real-time responses, pop up messages and alerts.

8.2.4 Findings Outside the Situation Awareness Cognitive Criteria

Outside the situation awareness cognitive criteria, context is ‘key’ during application design. Preece and Rombach (1994) note that when designing applications with human computer interaction culture, emphasis must be placed on theories about how humans process information and interact with computers, other objects and other people in the organizational and social contexts in which computers are used. Several authors have characterised context variables in the form of environment, user profiles, policy and legal context and framework, technology, structure, size, strategy and culture (Chenhall, 2003; Fauzi, Hussain & Mahoney, 2009). This study renders support to Elton, Nicolle and Mitchell (2008: 5), who admit that context is multi-faceted.

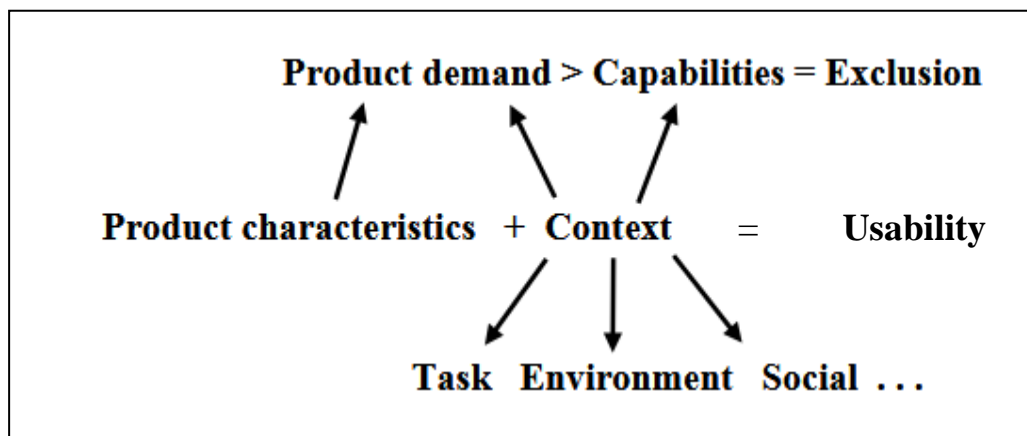


Figure 42: Multi-Faceted Impact of Context

(Source: Adopted and modified from Elton, Nicolle & Mitchell, 2008: 5)

The demand associated with using a product is therefore a result of both the product characteristics and the context in which the product is used. The user's capability to cope with this demand, and whether the demand results in exclusion, may also be affected by context. A holistic view of context needs to recognize not only the abilities and limitations of people within set environments, but also their needs, possible coping strategies, attitudes, motivation and aspirations towards existing or emerging products, technologies and services. The above figure therefore forms a contextual theoretical model to aid thematic categorization of the codes. The most prominent context-related issues were the user profiles that influence the participatory design evaluation process. User profile themes included are depicted in the network figure below:

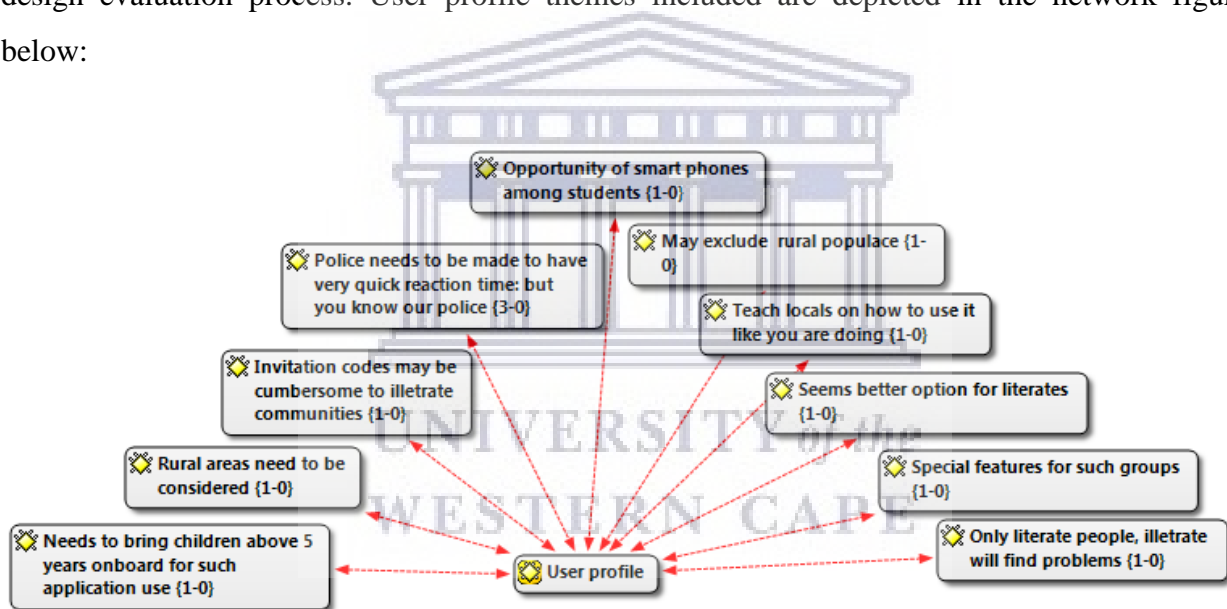


Figure 43: User Profile Context Themes

Issues from citizens' perspectives are literacy levels, habitants (rural/urban citizens), citizen age (children compared to adults), profession or department, livelihood means (students compared to working adults) and special needs groups among others. These were reported to influence the involvement and usage of the application during the participatory design process.

It can thus be summarised that situation awareness cognitive criteria of perception, comprehension and projection is a key evaluation criterion for artefacts. Other issues that fall

outside the situation awareness cognitive criteria form part of the context. Figure 46 presents a theoretical juxtaposition using artefact evaluation constructs and the design process herein termed as a ‘Participatory Design Situation Awareness Theoretical Framework’.



8.3 A Participatory Design Situation Awareness (PDSA) Theoretical Framework

Figure 46 depicts a Participatory Design Situation Awareness theoretical framework for citizen-centric design of e-services (e-government) for marginalised communities (includes situation awareness, processes, methods and construct) with a Realist’s Context Mechanism Outcome configuration (CMOc) as an underlying analytical lensa.

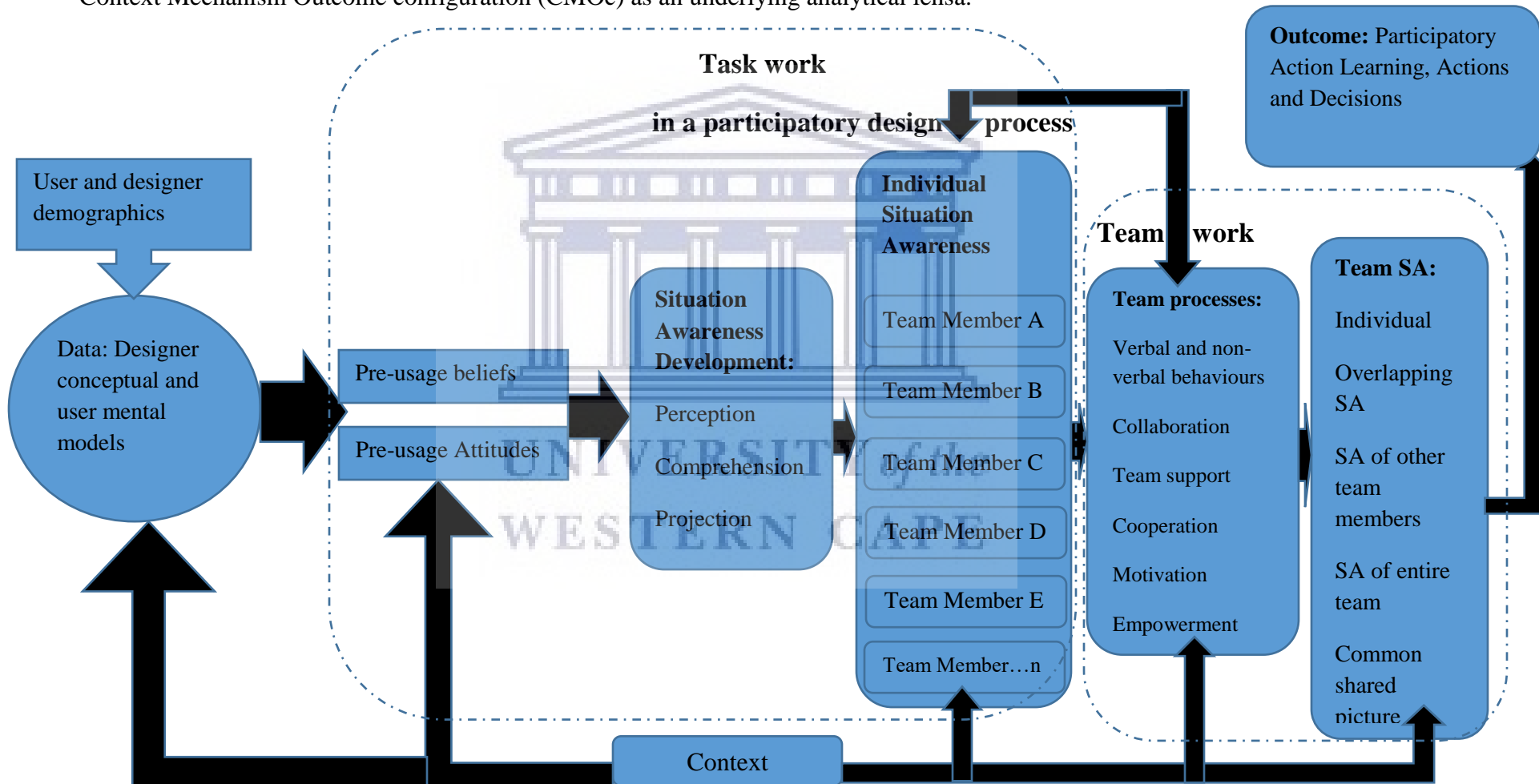


Figure 44: Participatory Design Situation Awareness (PDSA) Theoretical Model

Participatory Design Situation Awareness (PDSA) theoretical model was based on Endsley's situation awareness theory (Endsley, 2015) and Kelly's Personal Constructs Theory (Kelly, 1995). PDSA approaches situation awareness from participatory and collaborative working as an emergent framework from individuals to group mental processes as determined by the users' mental models and designers' conceptual models based on bi-polar constructions. From a critical realist's view, reality is an open system in which the effectiveness of causal mechanisms (e.g., participatory design) is dependent upon them acting with appropriate causal contexts (e.g., team setting, team composition, team certainty among others) (Fox, 2018).

At the onset of a design process, the designer and user mental model formed around a computer-based system is crucial to the effective and efficient design outcomes. Mental and conceptual models is the means where humans (users and designers respectively) are able to generate descriptions of a system's purpose and form, as well as how the system could function and predict future system interfaces and functionality (Scheutz, DeLoach & Adams, 2017; Walch, 2018). Moreover, from a critical realist's view, such shared mental models are a means by which agents establish their understanding of their environments and situations (Downward *et al.*, 2002). It is therefore crucial that the two models accurately reflect the application designed. Norman (1986) explains that a user can manipulate a system of the user model and is closely aligned with the design model (the mental model of the system held by the designer) as seen through the system image. PDSA is achieved through coordination between individual, team members and groups and systematically viewed. Whereas individuals possess their own situation awareness based on their personal constructions, they share this understanding of the situation among themselves within a given context (Sorensen & Stanton, 2016). PDSA from a citizen e-government design context reveals no single member has the overall all situation awareness, rather it is distributed among and around the overall team members during system design.

This study renders support to Sorensen and Stanton (2016) who conceptualized team situation awareness as the active construction of a model of a situation within a given context partly shared and partly distributed between two or more agents (co-design team or participatory design team), from which one can anticipate important states in the near future. Moreover, Endsley (1989) conceptualized team situation awareness as the degree to which every team member

possesses the situation awareness required for his or her responsibilities. Team or group situation awareness knowledge is distributed across the agents and the artefacts comprising the system and these knowledge themes or topics or descriptions labelled as ‘constructs’ defining elements represent what the participatory design team need to know in order to achieve success during task performance (Demir, McNeese & Cooke, 2017). When escalated among other members within a homogeneous design context, the same processes of construct formation and distribution will be supported (Salmon, Stanton, Jenkins, Walker, Young & Aujla, 2007).

Situation within a given context requires use of appropriate knowledge (held by individuals and captured by devices like use of computer based Atlas Ti) that relates to the state of the environment and the changes as the situation develops. In fact, some authors have argued differently that the ownership of this knowledge is initially at the system, rather than individual level, relating it to a notion of meta-situation awareness (Stanton, et al., 2006). The details of this debate is out of scope of this thesis. This thesis alludes to the fact and conclusion that individual situation awareness are not redundant, or do they provide an alternative, but they complement each other to viewing and describing collaborative and collective decisions and actions, under this case use/non-use, adoption or non-adoption of e-government applications within a marginalized contexts as determined by participatory action learning, through individual and team situation awareness. This is as was concluded by Demir, McNeese and Cooke (2017) that team verbal behaviour for example will positively or negatively influence team performance. This was revealed so during the empathetic participatory design process among the co-design team members and during the participatory design usability experiencing phase during the field artefact testing among citizens.

CHAPTER NINE

CONCLUSIONS, RECOMMENDATIONS AND CONTRIBUTIONS OF THE STUDY

“There has been a bias to action, not a bias to knowledge. We are changing the world without interpreting or understanding it (Heeks, 2007), exacerbating the design-reality gaps in e-government design interventions,” (Gonzalez-Zapata & Heeks, 2015)

9.1 Introduction

This study has resulted into development of a marginalized citizens’ e-government participatory design framework that has potential to bridge the design-reality gaps eminent in most available design frameworks whose focus is on formal organizations. The conclusions, recommendations and contributions made by this study therefore, are aligned to several scholars who have challenged the e-government research fraternity to revisit their research strategy in a bid to bridge the e-government and related information systems design-reality gaps. Examples of such scholars include: Hartwick and Barki (1994), Heeks (2007), Heeks and Bailur (2007), Hague OECD (2008), Gomez and Pather (2012), Linders (2012), Gregor and Hevner (2013), Gray (2013) Gonzalez-Zapata and Heeks (2015) and of most recent a study about digital government by Gil-García, Dawes and Pardo (2018). This thesis offers a course of direction by advocating for a participatory design framework through design science research paradigm, co-design through empathetic participatory design, design thinking and design mindfulness as a suitable strategy to avert the inconsistencies and contradictions in the design of e-government applications for marginalized citizens in developing contexts.

The contribution of design science to the information systems discipline has been under debate among scientists and in conference forums. From such debates and critiques, scholars have endeavoured to revert to design science research – which itself has been subjected to critiques regarding the nature of results and outcomes of studies. Some have argued that design science research contributions should focus on artefact development, others on methods and others on theory. In this study, the researcher adopted a multi-view or multi-methodological perspective to address such critiques, being aware that every study has limitations and is open for debate. Based on achievement of the main objective of the study (a framework for design of citizen-centric e-

government applications), this chapter presents methodological, practical and theoretical contributions of the study.

9.2 Design research Activities summarized

To achieve the above research objectives, the following high-level design phases were undertaken using actual design work undertaken:

- a) **Phase one:** Generate ideas through active involvement from citizens: Ideation (To design team, it is Co-problem discovery though in actual sense it is ideas generated from citizens/ideation). Design team uses reciprocal technical know-how (explicit knowledge) to validate users' tacit ideas to discover the actual problems. Do we see the similar ideas into one problem lens for design? This is problem discovery ushering into the definition (scoping) phase that follows. Structured survey was used for status quo discovery together with reflective interviews and FGDs.
- b) **Phase two:** Design team draws insight from these ideas to generate real designable problems: empathy (Detailed co-problem discovery and partial scoping); role plays, observations, reflective thinking. [Low fidelity prototypes with paper prototypes, Expressive user persona/role plays, RepGrid technique].
- c) **Phase three:** Detailed iterative practice based problem scoping: empathetic participatory design (Co-problem discovery and scoping) [Middle fidelity prototypes using simulation wireframes using Justinmind]
- d) **Phase four:** In-house development of the prototypes as artefacts: empathetic participatory design (Co-develop) [Middle to high fidelity prototyping using simulators-Justinmind]; observations, presentations, demonstrations through switching roles as users and designers, close ended questionnaire. Artefact evaluation criteria developed in-house/behavioral simulation.
- e) **Phase five:** Take artefact/prototype to citizen users to feel through hands on use/testing and appraisal/evaluation (usability experiencing); feedback from citizens help the co-design teams to undertake in-house high fidelity prototyping and later present them among the community users to align their ideas with what is developed/designed. The developed artefact evaluation criteria is assessed among users through simulation. Close ended questionnaire is used to undertake the artefact evaluation corroborated with interviews to discover other design issues not covered in the close ended artefact evaluation questionnaire.
- f) All phases a)-e) involve context examination and assessment so that it is incorporate into design.

9.3 Key Conclusions Made From the Study

In Chapters Seven to Ten, it is observed and concluded that conducting research with a design approach offers several benefits that complement the pure scientific methods of enquiry dominating the current HCI research. This research through design offers the following:

1. It reveals the mismatch between marginalised citizens' lived experiences and needs and the e-government commitments. This implies that service demand is not aligned well to service supply and the participatory design framework resulting from this study contributes to filling that gap.
2. It allows the Human Computer Interaction (HCI) research community to address the appalling problems in the field, creating an ongoing dialogue on what the preferred state of citizens' lived experiences should be. Such dialogue is needed as marginalised communities aspire to address complex issues, such as the effective and efficient appropriation of technology as a solution to their pressing needs amidst other competing needs that are hampered by financial and logistical constraints.
3. It allows for the development of solutions that consider relations between multiple phenomena in the design space, instead of trying to control for many variables and focus on a single relationship. This study revealed that Davis' enhanced TAM model with ease of use, benefits of use, learnability, ICT support and benefit expectations as causal inference variables of e-government use accounted for less than 30% in the model. This implies that the rest of the confounding issues had to be realised during the participatory design process through artefact simulations.
4. It creates research outcomes that communicate through models, methods and artefacts as design exemplars. This allows practitioners and researchers to apply the patterns they see in the research artefacts as they begin to make things that address the same or similar problematic solutions.
5. It addresses the need for the HCI community to explore the profiles and contexts of marginalized citizens during technology design and how such new technologies can advance current and future needs as marginalised communities engage with their respective government units.

6. It allows information systems researchers to expand their focus beyond that of evaluating current technology use, to that of investigating how future technological products and services can affect people. This reduces the risks of making new technology systems implemented in a technocratic top-bottom model that fail and lead to waste of public fiscus. Such a research paradigm increases the likelihood of discovering new opportunities for technology that adds value to the lives of marginalised people.
- g) All phases a)-e) involve context examination and assessment so that it is incorporate into design.

9.4 Recommendations

Marginalised citizens in developing contexts like Uganda have a cycle of competing needs and requirements. Most of needs are intangible: personal in nature, others are economic and social needs. Such intangible requirements need to be well understood if usable e-government applications are to be designed for them. Results based on the 4Co-Ds methodology reveal that among the several methods of designing for the marginalised communities, designers should put aside their own design intuition and design ambitions and incorporate empathetic co-creation. During usability experiencing, designers should corroborate empathetic co-design with several iterations of user involvement to refine the design process and resultant artefact. The study also determined that user representation involvement narrows the design-reality gaps, thereby achieving the alignment of user mental models with the designer conceptual models. Lastly the study demonstrates that participatory incorporates implicit and explicit knowledge into the design space thereby enriching the information systems design body of knowledge.

In this study, the following recommendations reflect the essence of citizen-centric design for bridging the e-government design-reality gaps, depending on context. These recommendations which emanate from the empirical evidence are proposed to improve design practice to realize design of citizen-centric e-government applications for marginalised communities:

- a) At the onset of design of e-government for marginalised communities, governments' ministries with a vested mandate should operationalise a co-design team comprising of information systems practitioners.
- b) Upon establishment of the e-government co-design team, there is need for an e-government design theory of change framework-ToC (as proposed in this study), a high-level perspective on achieving improved e-service delivery. Such a ToC is necessary to

inform the co-design team and participatory citizens' motivations, assumptions and anticipated results that contribute to the overall programme goal of e-government service usability and adoption among marginalised citizens.

- c) The team should base the design process on a framework based on what works and what does not work in given citizens' contexts, while aligning with available policy context and e-government strategic directions.
- d) Such an alignment reveals the design-reality gaps at project inception where a co-discovery process is executed, the outcomes of which must then inform e-government's priority setting and associated budgeting. This is because the design-reality gap is more than just a mismatch of needs to the design processes that currently neglects citizen-users. Such design-reality gaps have left citizens in a negative status quo concerning e-government use and adoption. Undertaking participatory design among design team and citizens results in the establishment of the extent to which the profiles of the citizen-user and co-designers influence the design outcome.
- e) The design team should sample a similar marginalised context and undertake structured and non-structured co-problem discovery and scoping. Such multi-methodology helps the design team acquire multiple perspectives of citizens in a complex vicious cycle of needs and requirements.
- f) The team should commence empathetic participatory design or user simulation, allowing for an in-depth understanding of the supposed personae of citizens through the building of prototypes for urgent and prioritized needs in various scenarios and iterations. The number of iterations and prototypes depends on the problems scoped, as well as the resource and time availability of the co-design team. Empathetic participatory design should also incorporate multi-methods to dialectically understand the multiple viewpoints for marginalised communities' complex world. The prototyping and prototyping evaluation should go through design and simulation of low-, middle- and high-fidelity prototyping that involves usable e-government application interfaces.
- g) Depending on the availability of time and resources, it is recommended the co-design team undertake iterations from the prototypes (low-, middle- and high-fidelity) simulated with potential citizen user groups. These processes should adopt a closed-ended structured tool for a wider survey coverage, based on a cognitive and human information-processing questionnaire and un-structured in-depth observations and interviews, to

reveal demi-regularities and other contextual issues. The number of iterations will depend on available time and resources. However, three (3) to five (5) iterations among three to five groups or categories of user citizens stratum is sufficient.

Finally, after design prototyping iterations and upon refinement of the design tools and prototypes, the e-government design agents should undergo detailed e-government application coding and design, co-delivered during a commissioning ceremonies, motivate early adopters to enable them show cause for use among other fellow citizens and to ensure sustainable use and further awareness.

9.5 Contribution to the Information Systems Body of Knowledge

Figure 46 presents the snapshot contributions of this study as follows: 1) theoretical contribution (dimension one); 2) methods contribution (dimension two); 3) methodological contribution (dimension three); and 4) meta-scientific contribution (dimension four). The contributions of this study are consistent with Gregor and Hevner (2013) who observe that design science research should aim at design of novel artefacts and their application into an application context with measurable improvements; and addition of new prescriptive knowledge contributions in the form of artefacts and nascent design theories to extend and generalize knowledge contribution of the DSR project. The results of this thesis generated these contribution, and over and above to the philosophy of science debates. The detailed elucidation is provided in the sections that follow.

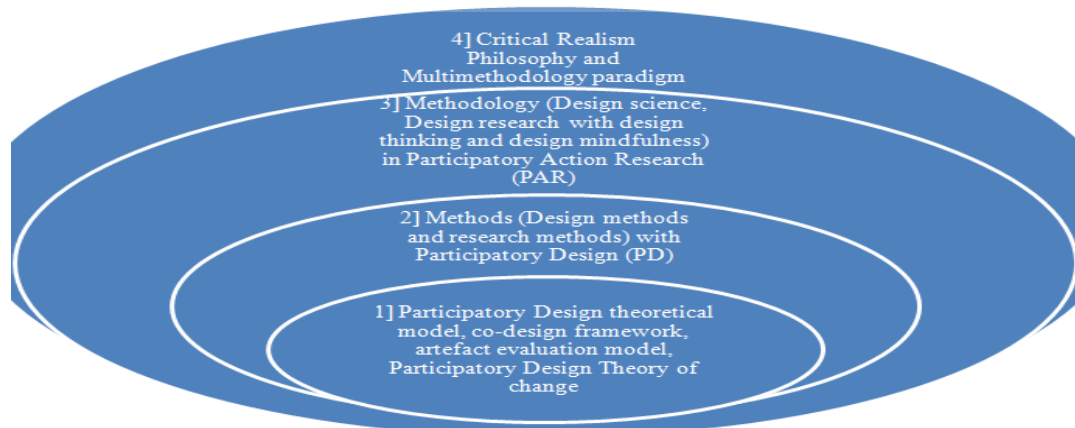


Figure 45: Study Contributions Stratum

The primary research question that this study addressed was: *What is a more realistic participatory design research framework approach undertaking citizen-centric design in order to address the design-reality gaps during e-government services application development, in a developing country context?* Specifically, and based on objective five of the study, the researcher synthesises the research and design processes into a framework for marginalised citizens e-government application design. The first contribution presented is at level 1 of figure 47.

9.5.1. Participatory Design Situation Awareness Theoretical Model

contribution

One of the outcomes of the participatory design process as presented in Chapter Ten (Figure 46, page 231) is a Participatory Design Situation Awareness (PDSA) Theoretical Model. To the information systems body of knowledge in general, e-government design for marginalized communities in particular, the proposed model actualizes the critical use of **situation awareness constructs**, while at the same time being **design mindful** in a participatory design context. Participatory design targets user behaviour. The theoretical model proposed in this study suggests that context must be interwoven into design requirements during the design of e-government applications for marginalised communities and that adoption models cannot be treated as a one size fits all.

9.5.2 Design-Reality Theory of Change for Design of Marginalised Citizens' e-Government Applications Design

Information systems are purposefully designed human endeavours that call change of humans from one unpleasant situation to a desired one. Therefore, the overall success of the participatory design research process may be determined by the researcher's assumptions and a theory of change for which we offer a starting point other researchers. Theory of change offers a participatory process whereby groups and stakeholders in a planning process articulate their goals and identify the conditions they believe must unfold for those goals to be met. These conditions are modelled as desired outcomes and arranged graphically in a causal framework (Taplin & Clark, 2012). Moreover, in an attempt to develop new ideas and solutions in response to social needs, a theory of change is a powerful approach, especially when related to systemic thinking, prototyping and visualising with marginalised communities (Hillgren, Seravalli & Emilson, 2011). Similar to the realist's context mechanism outcome configuration, formulating an evidence-based theory of change (ToC) is an essential step in developing a context-sensitive

design for ICTs. It is used to describe the set of assumptions that explain the steps leading to the intended outcome of participatory design intervention. As such, the ToC articulates expectations regarding how and why a given intervention will lead to a specific change and is used for purposes of the strategic planning, monitoring, and evaluation of an intervention (Breuer *et al.*, 2018).

Theory of change is a rigorous yet participatory process whereby groups and stakeholders in a planning process articulate their long-term goals and identify the conditions that must be met for those goals to be achieved. These conditions are modelled as desired outcomes, arranged graphically in a causal framework (Taplin & Clark, 2012).

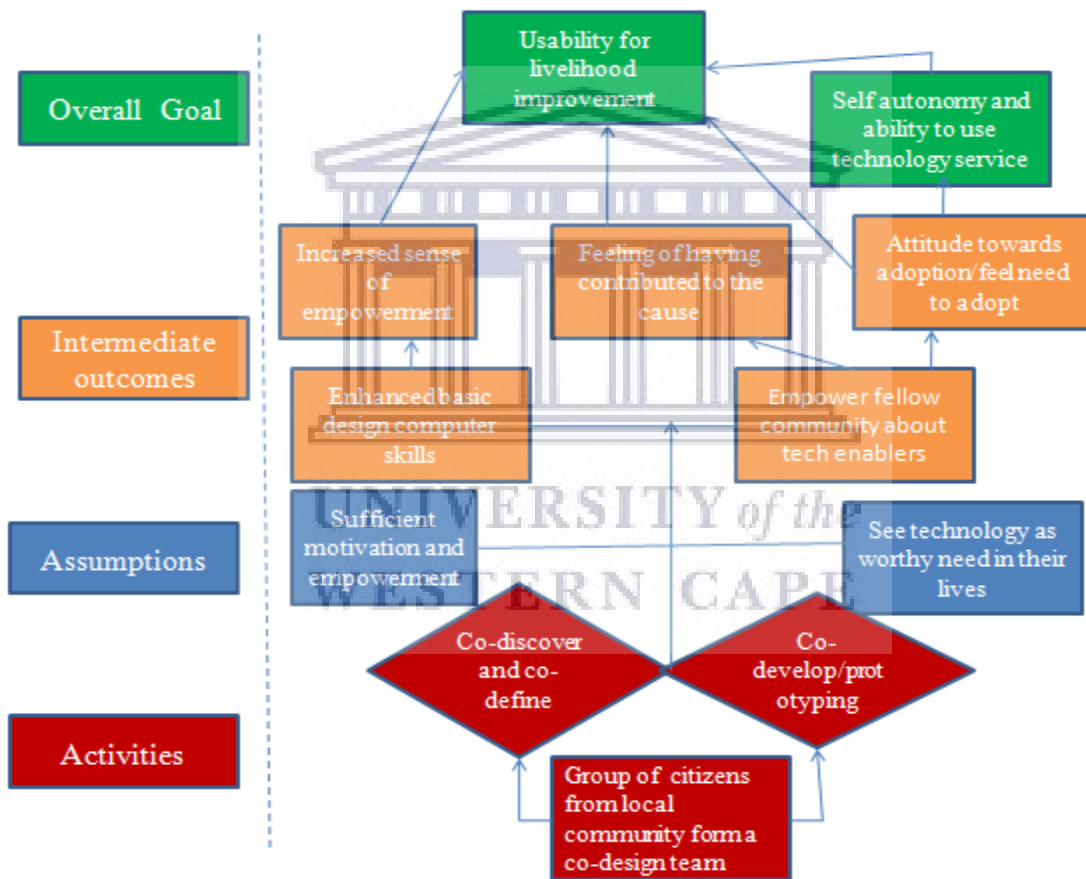



Figure 46: G2C Design-Reality Gaps Theory of Change

Legend:  Co-Design processes

 Project activities, assumptions and objective of design processes

The researcher developed the above programme logic during the participatory design process from the citizens' experiences in respect of e-government interventions herein referred to e-

services and the co-design team process insights and experiences. ToC is consistent with the realist's CMOc in that it describes the types of interventions (a single program or project or coordinated initiative) that generates the outcomes depicted in the outcome framework map (Punton, Vogel & Lloyd, 2016). This is because the intervention has mechanisms that have generative powers to bring desired change, thereby revealing a complex web of activity that effects actual change. From a realist's perspective, causal mechanisms must go beyond whether the programmes work to explain how they work and under which circumstances (Astbury & Leeuw, 2010). Below, is a description of the four components of the ToC framework presented in Figure 48:

Overall Goal

From the above ToC framework, it is envisioned that government convenes a co-design team with citizen groups from the local community as an integral part of the team. The ultimate goal is to adopt e-services (technology) that improve their livelihood and well-being with an assumption that their current realities are to be incorporated and embedded in the artefacts designed. Another underlying assumption is that citizens will achieve self-autonomy and the ability to use the technology services to engage with government. The following steps follow a backwards mapping from the long-term goal by working out the preconditions or requirements necessary to achieve that goal and explain why.

Activity Level

The objective of a governmental participatory design team comprising of citizen groups and co-design team members is to develop usable e-government applications. This is contrary to the usual government top-bottom approach of design that results in design-reality gaps. Alternatively, groups of citizens may come together in relation to any other intervention if the goal is related to improvement of the welfare of marginalised communities. These groups could be influential enough to invoke social action and community transformation. Under this study, they included the following: self-help groups for women, youth groups in and out of schools or in university clubs, small-scale community business networks (SMEs) and community village health volunteers (VHTs). The pre-usage beliefs and attitudes of citizens were revealed from the participatory approach. Furthermore, co-development with low-fidelity prototypes and presentation of actual artefacts may yield further insights into the design based on the citizens'

own application evaluation criteria. Key sub-activities were executed in a participatory manner. These ranged from co-discovery and co-scoping of the problems from vast ideas provided by citizens, application design process and application evaluation within underlying assumptions.

Underlying Assumptions

During the processes inherent in the activity level, the assumption is that the participatory design team will have sufficient motivation and empowerment while seeing technology as a worthy need in their lives. As such, this study embedded activities for citizens like basic hands-on computer training for the improvement of skills as well as reflective thinking about technology. The realisation of these assumptions resulted in intermediate outcomes.

Intermediate Outcomes

While there are likely to be immediate measurable results at the activity level, other results are intermediate (observable or unobservable). These include enhanced basic computer skills, technologically empowered citizens and the resultant desire to use and adopt technology. This ultimately contributes to the overall goal of usability and continuance to use technology for livelihood improvement. Realising the results chain may contribute to the national strategy set by the Ugandan Ministry of Information and Communications Technology, contributing to the alignment of the e-government strategy to the pressing needs of the citizens.

Such national alignment will contribute to the Global ICT mandate, as documented in the World Summit on Information Systems (2014), that calls for nations to rethink the IS design mentality of 'build it and they will come'. This is under WSIS action line C2 and C3 that challenges nations to provide rural access to ICT infrastructure and internet, moving citizens into the digital society.

9.5.3 Contribution to methods

At level 2, this study makes a contribution to the available design science methods through participatory methods. Key methods that were found to be very power for construct elicitation, yet they are less popular in the pactice of design research are expressive user personae, termed as role play and repertory grids. Whereas direct methods like questioning and interviews have dominated the elicitation of knowledge from experts, the experts needs to be very articulate and willing to share such information. The information has to be shared willingly by the expert or

respondent, which may at times prove to be a difficult task. Expressive user persona and the repertory grids were found to be extremely useful methods for elicitation of definitive constructs that could not be revealed during face-to-face interviews or any other direct method. Such methods strengthen the available classical direct methods that may be inappropriate for use among marginalized citizens who feel ease of demonstration through role plays. Both methods can be used during low fidelity, middle fidelity and high fidelity prototyping processes.

9.5.4 Methodological contribution

In the previous chapters of the thesis, I discerned between methods and methodology. Methodology is encompassing, where methods are part of the methodology. This study positions design science methods (design thinking and design mindfulness) like the fore mentioned (expressive user persona, repertory grids, use cases, use scenarios etc) within an overarching methodology of Participatory Action Research Design. Since the action component was design (research through design), this methodology can well be termed as Participatory Action Design Research, as has also been proposed for community informatics studies (Bilandzic & Venable, 2011). Moreover, use empathetic participatory design aids the co-design team to get into the real life world of users during in-house prototyping process and prior to user field simulation.

9.5.5 Use of empirical methods during participatory design research: A contribution to critical realist researchers

To the critical realist researchers at level 4, the first empirical contribution this study makes is to advance an artefact evaluation criterion during and after the artefact has been designed. This study shades light to the design scientists and philosophers of science who have mixed and differing views about attention given to the logic of evaluating participatory design research processes and outcomes. The researcher makes a contribution by observing that knowing relevant mechanisms is necessary for use of statistical inference and estimates are important to understand the process by which something has been brought about. Under causal inference, the focus is not on relationships between variables, but on the triggers, actors, their relationships and the intended and unintended outcomes of their actions, under this case, researchers, system designers and system users. To that note, casual inference is an inference mode in which events are explained by postulating (and identifying) mechanisms which are capable of producing them.

Moreover, to the scientific space, the researcher joins other authors who have advocated for the need for a modified ontological position from the philosophically pure case of an open system, to one which suggests that in social systems, individual and institutional experiments exist by use of what they term as quasi-closure. I argue that quasi-closure can provide leverage for researchers seeking to validate and generalize empirical insights about social processes and that the nature of what is potentially a completely open system is modified as a direct consequence of human action. In fact, this study too, emphasizes the need to use statistical modelling and call upon the many of the epistemological pronouncements of critical realism who are still suspicious of statistical methods to employ them in estimating the causal mechanisms. This is because statistical modelling can offer an explanatory power to causal inference through a retroductive process. This study renders support to Downward and Mearman (2002) who guide that drawing upon statistical modelling, a useful symbiosis of ideas is produced which has positive implications for the practice of critical-realist empirical work in efforts to examine mechanisms under play. This study concludes that whereas there exist opposition by dominant critical realist theorists to statistical analysis, we argue that statistical inference can be used as a measure to further strengthen the need for exploration of other mechanisms that fail to explain the casual model. This study affirms the importance of falsification and verification efforts for progress in theory development during design science methods.

In addition to the foregoing contributions, this study has resulted into the following research **outputs**:

- *Kyakulumbye S., Pather, S & Jantzie M (2019)*. Knowledge creation in a participatory design context. The use of empathetic participatory design. *Electronic Journal of Knowledge Management 17 (1)* Accessed at <http://www.ejkm.com/issue/current.html>
- *Kyakulumbye S., Pather, S & Jantzie M (2018)*. Creating knowledge in the design thinking process: Reflections on participatory design. A paper presented at the 15th *International Conference on Intellectual Capital, Knowledge Management & Organisational Learning* 29 - 30 November 2018, University of the Western Cape, South Africa Abstract accessible at <https://www.academic-conferences.org/conferences/icickm/icickm-abstracts-selected-2/>
- *Kyakulumbye S., Pather, S & Jantzie M (2019)*. Towards design of citizen centric e-government projects in developing contexts-The design reality gap among marginalized citizens. A paper accepted for publication in the *Special Issue Edition in International Journal of Information Systems and Project Management*

- *Kyakulumbye S, Pather, S & Jantzies M (2019). Understanding ICT adoption amongst SMEs in Uganda: Towards a co-creation model to enhance technology diffusion. A paper sent to African Journal of Science, Technology, Innovation and Development*
- *Kyakulumbye S, Pather, S & Jantzies M (2019). Emperical methods during a participatory design research: A Critical realist's perspective. A paper submitted to the Special Issue Edition for Journal of Critical Realism*
- *Kyakulumbye S, Pather, S & Jantzies M (2019). Towards an Information Systems Design Science Research Cognitive Artefact Evaluation Model. A paper accepted for oral presentation at the 12th Academic International Conference on Social Sciences and Humanities to be held on 18th-20th November 2019 in Boston, USA*
- *Kyakulumbye S, Pather, S & Jantzies M (2018). "Harnessing technology to improve health care service delivery within a resource constrained environment-A case of Naggalama Hospital, Uganda," was presented at SASUF Session under theme, Understanding the Burden of Disease in Sweden and South Africa, and its Impact on the Health Systems of the two Countries in the Future -18 May 2018 at School of Public Health, University of the Western Cape.*
- *Kyakulumbye S, Pather, S & Jantzies M (2018). 'An e-government to citizen co-design theory of change for marginalized communities in developing contexts' was accepted at the 2018 IFIP WG 9.4 European regional conference on the social implications of computers in developing countries organized from the 22nd to 24th June 2018 in Tirana, for presentation.*
- *Kyakulumbye S, Pather, S & Jantzies M (2018). "Towards a G2C E-Government Co-Design Conceptual Model in Developing Contexts" was accepted for presentation at the "ICEG 2018: International Conference on e-Government" held on Apr 23-24, 2018 in Boston, USA (World Academy of Science, Engineering and Technology.*
- *Kyakulumbye S, Pather, S & Jantzies M (2018). "A conceptual PhD working paper on citizen e-government co-design in developing contexts" was selected for oral presentation at the WEI International Academic Conference at Harvard Faculty Club in Boston, August 1 through August 3, 2018.*
- *Kyakulumbye S, Pather, S & Jantzies M (2019). Estimating causal mechanisms with statistical inference in a design research process. A paper presented at Ulmer Data Science Stammstish, Evo Mercedes Benz, Ulmer Germany, September 26th 2019.*

At a more operational and practical level, this study has culminated into the following outputs:

- At Uganda Christian University, informed by this framework, I spearheaded the review of the curriculum of Bachelor of Business Computing and Community Informatics to include course units of Human Computer Interaction and User Centered Designs.
- The Faculty of Business and Administration together with Faculty of Social Sciences, a Center for Civic engagement is to be piloted. It will have online community engagement

tools with some of the ones co-discovered in this study as focus e-government applications.

- In collaboration with Government Ministry of ICT, the Faculty of Business and Administration, Programme of Computing will be periodically collecting citizen requirements for intergration into the National e-government strategy. This is now through the Business and community outreach service culminating from this project.

9.6 Limitations of the Study

Due to our limited knowledge of reality, there is no perfect uncontestable study due to the inherent limitations, hence calling for further areas of research into similar or varied contexts. The major limitation of this study and such similar studies is the low citizen participation due to their low motivation and interest in public affairs and public good. Most public meetings are sparsely attended and those citizens who show up often represent organised interests and agenda that don't necessarily represent the interests of a broader community. This was mitigated by selecting broader community strata – the citizens in the SME sector in the Mukono District in this case. This study can be replicated in a similar or even more diverse context.

Within participatory action research and participatory design, each case and situation is unique in its own way, because the public consultations' goals, target groups and strategies applied are different. This makes the application of standard solutions difficult. To mitigate, each process involved a thorough planning of the objectives, target groups, multi-methodology tools, required resources and time as well as a proper communication and feedback strategy after the end of each participatory process.

Another limitation was the motivation of the marginalised citizens participating in the prolonged study process. The researcher constructed a theory of change with an inbuilt assumption to realise sufficient motivation. This included incentivised trainings, empathy enhancements to empower communities to solve their own problems, challenges to the status quo. It was important to emphasise that they needed to adopt to e-government initiatives if they were to remain in a digital shadow.

9.7 Suggested Areas of Future Research

Citizen-centric design of e-government applications is crucial if the lives of marginalised citizens are to be improved through use of ICTs. Although citizens may use such applications for service requests from the government, traditional bureaucracy hinders such delivery. This in turn limits citizen engagements with government, and later results in an aggrieved citizenry, festering animosity. This tension often sparks citizen protests and conflicts with the government and public administrators. Through a more detailed policy study, government ministries and local governments that interact with citizens must be assessed so that clogged points affecting service response and delivery are examined. This could be a context-based study for services provided to the diverse marginal sectoral communities like health, education, agriculture, SMEs under department of trade and/or police service under internal affairs.

A fresh study to conduct pilot implementation of the developed artefacts can be undertaken and process of use periodically monitored to establish usage patterns among the targeted communities. During this study we found that citizens believed police officers were most likely to be less or non-responsive to their requests. The researcher himself made requests through government websites but received no response due to available bureaucratic mindset of physical reporting at public offices. After identifying such points of non-response to citizens' requests, it is clear that ICTs should be piloted to ensure that such bureaucratic lines run smoothly. This is because bureaucratic organizations are not necessarily the main cause for the administrative and service crises in the public sector, but rather the increased complexity of the administrative procedures. Having an e-bureaucratic organization ensures logic of the bureaucratic mechanisms to coordinate the execution of organization activities, and hence to deliver services.

Although such e-government policies increase the level of interdependency among public offices, they underestimate the problem of increased administrative complexity that is associated with the integration of programmes (Edström & Galbraith, 1977; Cordella, 2006; Cordella, 2007). This runs the risk of government failing to deliver services to citizens. Despite the rapid diffusion of ICT-based innovation and the perceived “visibility” of the ongoing changes in public services, the rate of failure of e-government development projects is high (Contini & Lanzara, 2008). Problems and pitfalls in implementation prove the “Online One-Stop Government Model” a distant ideal (Wimmer & Traummuller, 2002).

Since governments are bureaucratic and rigid in their nature, e-bureaucracy could be a solution to the service delivery problem as the literature reveals that when an activity is delegated to a bureaucrat, they will carry out the rules and regulations or make a decisions in the public interest regardless of whether it benefits them (Tullock, 1997). In addition to e-bureaucracy, all integration policies should be thoroughly studied and designed keeping such integration risks in mind.

A future study could focus on identifying the demi-regularities and underlying mechanisms that this study revealed as contextual factors accounting for 76.7%. This can be conducted to test the proposed model through another similar or varied context. My recommendation is based on Miller and Tsang (2011) and Rigdon (2016) who advocate for advancing theory testing that identifies the presence and effects of hypothesised causal mechanisms, rather than solely focusing on correlational methods to jointly test the set of effects composing a theoretical system. Within critical realism, to theorise is to examine context based mechanisms that explain events we observe or not (Miller & Tsang, 2011).

Finally, after completion of this Doctoral phase, an area of further research to National Research Foundation at a PostDoctoral phase entitled, “*Technology-driven social innovations for enhancing civic engagement among impoverished communities,*” was suggested.

The proposed study was motivated by results of this study. My findings are backed by the view that whereas universities, civil society and private sector have led a way to support social innovators, technology-driven social innovations driven by the internet for citizen engagements in institutions is still at the peripheral of developing government’s strategies. Evident technology driven innovations are more of informational and transactional rather than participatory engagements by citizens for service delivery towards their elected leaders for furthering the objects of participatory democracy, e-governance and civic engagements.

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APPENDICES

Appendix 1: Memorandum of understanding between Supervisee and Supervisors

UNIVERSITY OF THE WESTERN CAPE

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

MEMORANDUM OF UNDERSTANDING BETWEEN POST-GRADUATE STUDENTS AND SUPERVISOR

The objective of the Memorandum of Understanding (MOU) is to outline explicitly the expectations of both post-graduate students and their supervisors. Clearly defined expectations regarding the responsibilities of all parties are crucial to ensuring good supervisory relationships.

The MOU should be viewed as a tool to assist in the planning and carrying out of a post-graduate project. It should not be viewed as an administrative burden. It represents statements of intent and the implied obligations are what a supervisor and student could reasonably be expected to meet under normal circumstances.

If a project changes dramatically, a new MOU should be completed in which the major changes are outlined.

A copy of the signed form should be submitted to the Faculty office via the Departmental PG committee. The student and supervisor should each retain copies for their own records.

AGREEMENT COVERING THE ENTIRE PERIOD OF THE DEGREE

1. STUDENT FULL NAME:

Stephen Kyakulumbye

2. STUDENT NO.:

3	7	5	9	6	0	6
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3. DEGREE: 4. 1st year of registration: PhD

5. Full-time



Part-time

6. EXPECTED DATE OF COMPLETION:

2019

7. DEPT:

Information Systems

8. PROJECT TITLE: A framework for the development of user-centric e-government applications in developing countries: The design-reality gaps in Uganda

9. BRIEF DESCRIPTION OF PROJECT (< 200 WORDS):

E-government should be at the heart of service delivery in developing countries if the lives of citizens, especially the economically marginalised, are to be improved. The penetration of the internet has greatly improved the ability to offer citizens access to government information and services. As a minimum, this brings government into reach of citizens who usually incur costly travel, over vast distances to access government services. In addition, e-government also allows citizens to engage in collaborative discussions on issues that affect their lives and well-being. E-government can also offer accountability and transparency to citizens in regard to services from the higher levels of government especially where physical access may be problematic.

The rationale to develop a model to improve the design of e-Government services is clear when the such many benefits are considered. Citizen-centric e-government has the ability to reduce the operational costs and improve efficiency in service delivery through effective and efficient usability of such services. For instance, Sigwejo, Bythway and Pather (2013) note that availability of 24/7 services embedded in e-government reduces time and cost to the government and to its constituent partners to interface with citizens at lower levels of government. Several other benefits are presumed to be associated with e-Government services which basically translate to provision of direct services to users instead of traditional flow of paperwork between the government and its citizens.

10. SUPERVISOR DETAILS:

Supervisor: Professor Shaun Pather Highest Qualifications: Doctor of Technology (IT)

Outline the main responsibilities of supervisor in relation to the research project:

- **To provide mentorship and coaching to the student during the course of research**
- **To offer regular guidance on the scientific and academic aspects (either face-to-face or via email) on the research project**
- **To monitor and evaluate the students' progress and provide direction for corrective course/s of action as and when necessary.**
- **To facilitate all required Senate governed Higher Degrees processes in relation to the degree.**
- **To undertake any other related tasks to ensure the successful examination of the student.**

Co-Supervisor(s): Dr Mmaki E. Jantjies

Highest Qualifications: PhD

Outline the main responsibilities of the co-supervisor

-To complement all of the above listed responsibilities of the principal supervisor, including regular meetings and feedback to the student

11. AVAILABILITY OF THE PRINCIPLE SUPERVISOR:

Highlight any absence of supervisor(s) foreseen during the duration of the student's degree. This should include leave/sabbaticals/extended overseas trips. If supervisor is envisaged to be absent for an extended period, (> 6 weeks) then arrangements for supervision should be clearly spelt out.

No periods of long absence envisage.

12. LEAVE OF ABSENCE OF STUDENT

- (a) Stipulate how much leave (per annum) the student would be entitled to. Where possible give an indication of dates.

There is no leave envisaged at this stage of the research. The student has obtained a leave of absence from his full-time employer in Uganda.

- (b) Outline any arrangements for the student to undertake extended periods of research work to be done away from UWC. Supervision and funding arrangements during this time should be clearly defined.

Field data collection is envisioned to take three to four months within 2018 due to its iterative nature (collection, design, analysis and documentation). During this period, there will be online iteration meetings via Skype and email communications. We shall have either an Ikamva account and/or we already have a Google drive account to handle most of our datasets.

13. **PRESCRIBED COURSES/WORKSHOPS** Agree on any formal courses, workshops etc. the student would need to attend as part of his/her degree programme.

A schedule of prescribed research workshops has been provided to the student. He is expected to attend all of those. In addition, as further development needs are identified the supervisor will direct the student accordingly.

14. **TIME ALLOCATION**

Outline the number of hours/week the student is expected to spend in the lab/field and on the project as a whole. Where possible break this down into more clearly defined task as per the categories below: (additional categories can be added)

The student is expected to spend a minimum of 45 hours per week on the research. A detailed work plan is indicated in the proposal.

15. **SPACE ALLOCATION:**

Indicate where the student would have lab space and whether a personal bench/desk/office would be available:

There is regrettably no dedicated personal work bench. The student does have access the EMS post-graduate laboratory. He does have his own laptop and can therefore work at any campus location to his discretion.

16. **COMPUTER FACILITIES**

Define the computer facilities available to the student. Specify the arrangements regarding access to these facilities.

A normal desktop computer running either Windows or Linus is required. The student will need to utilise Atlas Ti, SPSS as a minimum, and installation to the latter, will be facilitated by the supervisor.

17. **FINANCIAL ARRANGEMENTS FOR THE PROJECT.**

The student is funding his own research costs. The supervisor will assist and support his applications for research grants for further support.

18. **PUBLICATION ISSUES**

- (a) In preparing manuscripts for publication, who will be responsible for writing the first draft? Who will the first author and who will be listed as the corresponding author?

The student writes the first draft after a conceptual framework has been developed with the supervisor. The first author is the student followed by the supervisor.

- (b) Will the student be a co-author on any other academic outputs that may arise from results obtained from the student's project?

The student will be a co-author on any other academic outputs that arise from the results.

- (c) Data Ownership.

All data remains the property of the University, on an open access basis. The student is however permitted to continue to use, re-use and build on his data.

19. Outline any issues regarding the ownership of data obtained from this project. This should include the ownership or lab-record books, notes, computer disks etc.

None.

20. ARRANGEMENTS AROUND COMMUNICATION

(a) How often will student have scheduled meetings with supervisor(s)? (It is suggested that a formal meeting takes place at least once a month).

One formal progress meeting with both supervisors is scheduled once every three weeks. However, the student is free to meet with either supervisor in between these scheduled meetings.

(b) Define the nature of the meeting, e.g. one on one, research group, and seminar:

These are one-on-one meetings.

(c) Outline the format of the meeting, e.g. discussion, presentation:

The meetings comprise discussion, and presentations.

(d) How will the student access the supervisor for unscheduled meetings or to ask advice?

Via email, telephone or face to face and Skype.

(e) Progress Reports: How often will the student be required to submit a progress report? Outline the format of the report.

The progress report is submitted once annually.

(f) Supervisor, Response Time: Outline the time period for the supervisor to give feedback on a progress report. Also stipulate the format of the feedback (written/verbal/annotation of report).

Feedback is to be provided not later than 10 days after the submission of a substantive piece of work (e.g. a draft chapter), or within 5 days on short submissions (e.g. a sub-section of a chapter).

21. STUDY OUTPUTS:

(a) (i) Full thesis/mini thesis/project report? **Full thesis**
(ii) Give supervisor's response time for reviewing thesis drafts. **On a chapter by chapter basis (up to 10 days per chapter)**

(iii) How many drafts of each section of the thesis will the supervisor review? **3 drafts**

(b) Publications expected other than thesis itself? **At least two conference proceedings (if funding is available); and at least two journal articles.**

(c) Seminars: List the seminars the student is obliged to attend.

These will be determined on a needs basis. None are identified at this time

22. RESEARCH VISITS / CONFERENCES:

None.

23. OTHER DUTIES: Outline any tasks the student is expected to perform for the research group. Give the number of hours/week.

The student will provide up to two hours of advisory work a week, in relation to honours students who are working on the same research theme.

24. OTHER EXPECTATIONS: Highlight any other expectations for the year.

None for none but may be prescribed as and when they appear.

25. OUTLINE ANY OTHER ISSUES RELEVANT TO THIS PROJECT.

None

Student: *Ngizakumbiye*

Date: 9/10/2017

Supervisor:

Date:

Co-Supervisor:

Date:

Dept Chair/PG Coord.:

Date:



UNIVERSITY *of the*
WESTERN CAPE

Appendix 2: Information Sheet and In-depth interviews schedule for case unit 1 (e-Government Officials)



Faculty of Economic and
Management Sciences
Department of Information Systems



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Information Sheet (In-depth interviews for Government Officials)

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Project brief

My name is **Stephen Kyakulumbye**, a student at the University of the Western Cape (South Africa) pursuing a Doctor of Philosophy (PhD) in Information Systems at the Department of Information Systems Faculty of Economic and Management Sciences. I am conducting a study aimed at designing a feasible e-government to citizen co-design framework for developing contexts among marginalised rural communities. This study is solely for academic purposes. However, the results of this research will be shared with the Ministry of Information and Communications Technology; concerned local government to citizen service delivery through technology. Your personal details shall remain strictly confidential and anonymous, and the study does not intend to harm you in any way. I thank you in advance for your participation.

Purpose of the Study

As we have indicated, the project will be undertaken to explore the user-centric (or citizen-centric) approach feasible to address the design-reality gaps in e-government services application in a developing country context.

Procedures

During the research process, we wish to ask you for permission to use our prototypes and assignments co-generated by your participation in the due course of the study. Furthermore, we would also like to ask your permission to be interviewed about your experiences or any designated personnel regarding such similar studies for corroboration purposes.

Potential Risks and Discomforts

There are no risks associated with this study. However, should any participant wish to withdraw from the study process, s/he will be free to do so. If one wishes to withdraw during the debriefing interview at the end of the course, one may also do so.

Potential Benefits to Participants

It is anticipated that this collaborative working or participatory design has a long-term of effective use of e-government application services hence adoption and continuance for use.

Remuneration for participation

There are no remunerations for participating in the project.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with participants will remain anonymous and confidential and will be disclosed only with permission or as required by law. Confidentiality will be maintained by use of pseudonyms in publications. Furthermore, any background information that will make identification possible will not be included in any academic paper or public document. With regard to the prototypes and the interviews conducted, you will have the right to review the data to be used and to edit any information which pertains to you.

The right to withdraw and to remain in the project

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Letter of Consent (In-depth Interviews for Government Officials)

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
A	I agree to participate in this research project.	
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C	I understand that I was selected to participate in this study due to my [expertise / position] (delete as applicable.)	
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Sample interview questions (Government Officials)

- a) To what extent are the information needs of citizens integrated into the design process of the e-government applications in place? How do you go about citizen requirements gathering?
- b) What are some of the targeted e-government applications in place for marginalised citizens at country level, province level or district level?
- c) How was the scoping undertaken to integrate citizen requirements into the design?
- d) What are some of the government services that are statutory, mandatory, necessity to citizens and at the same time beneficial to them and to the government?
- e) What do you think are the causes of obstacles to capture citizen information?
- f) If citizens are unwilling to submit such information, why? If they have shown willingness what do you attribute this to?
- g) What efforts have been undertaken to make forms available to citizens for use? Which of these efforts do you perceive to be successful and why?
- h) How are citizens approached in order to have their voices incorporated into the designs of application service development?
- i) How can citizens be approached in order to have their voices incorporated into the designs of application service development?
- j) If citizens are unwilling to submit such information, why? If they have shown willingness what do you attribute this to?
- k) What efforts have been undertaken to make forms available to citizens for use? Which of these efforts do you perceive to be successful and why?

Appendix 3: Sample questions checklist for e-government policy documents

- a) To what extent are the information needs of citizens integrated into the design process of the e-government applications in place? How do you go about citizen requirements gathering?
- b) What are some of the targeted e-government applications in place for marginalised citizens at country level, province level or district level?
- c) How was the scoping undertaken to integrate citizen requirements into the design?
- d) What are some of the government services that are statutory, mandatory, necessity to citizens and at the same time beneficial to them and to the government?
- e) What do you think are the causes of obstacles to capture citizen information?
- f) If citizens are unwilling to submit such information, why? If they have shown willingness what do you attribute this to?
- g) What efforts have been undertaken to make forms available to citizens for use? Which of these efforts do you perceive to be successful and why?
- h) How are citizens approached in order to have their voices incorporated into the designs of application service development?
- i) How can citizens be approached in order to have their voices incorporated into the designs of application service development?
- j) If citizens are unwilling to submit such information, why? If they have shown willingness what do you attribute this to?
- k) What efforts have been undertaken to make forms available to citizens for use? Which of these efforts do you perceive to be successful and why?

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Appendix 4: Pre-system usability citizen questionnaire (pre-test phase among case unit 2-rural hospital)



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Information Sheet (Pre-system usability questionnaire for citizens)

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Project brief

My name is **Stephen Kyakulumbye**, a student at the University of the Western Cape (South Africa) pursuing a Doctor of Philosophy (PhD) in Information Systems at the Department of Information Systems Faculty of Economic and Management Sciences. I am conducting a study aimed at designing a feasible e-government to citizen co-design framework for developing contexts among marginalised rural communities. This study is solely for academic purposes. However, the results of this research will be shared with the Ministry of Information and Communications Technology; concerned local government to citizen service delivery through technology. Your personal details shall remain strictly confidential and anonymous, and the study does not intend to harm you in any way. I thank you in advance for your participation.

Purpose of the Study

As we have indicated, the project will be undertaken to explore the user-centric (or citizen-centric) approach feasible to address the design-reality gaps in e-government services application in a developing country context.

Procedures

During the research process, we wish to ask you for permission to use our prototypes and assignments co-generated by your participation in the due course of the study. Furthermore, we would also like to ask your permission to be interviewed about your experiences or any designated personnel regarding such similar studies for corroboration purposes.

Potential Risks and Discomforts

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Potential Benefits to Participants

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Remuneration for participation

There are no remunerations for participating in the project.

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Letter of Consent Pre-system usability questionnaire for citizens)

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
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Pre-system usability questionnaire

Part one: Demographic data

<p>INSTRUCTIONS: This tool has been developed considering the issues related to services you may require from government and services required to be delivered to citizens. They may be statutory/mandatory, necessity to citizens and yield explained or direct observable benefits. The purpose of this study is to design an e-government design process for citizens taking a participatory approach. Please enter code in data entry column tick the most appropriate answer in section one and offer open free dialogue in the following sections. Additional instructions are provided in italics. In the event that additional information is required, you will be informed accordingly. Once completed, submit the questionnaire back to the facilitator.</p>			
SECTION ONE: PERSONAL INFORMATION			Data Entry
1	Participant code number		
2	Participant National ID Number		
3	Gender of Respondent <i>(circle one number)</i>	1 = Female 2 = Male	<input type="checkbox"/>
4	Age of Respondent <i>(tick in brackets)</i>		<input type="checkbox"/>
5	Employment Status	1. Not employed 2. Family business 3. Formal job	<input type="checkbox"/>
6	Marital status	1.=Single 2= Married 3=Divorced 4= Widowed	<input type="checkbox"/>
7	Period of stay in the area <i>(sub-county)? (Tick Appropriately)</i>	1= [Less than 1 year] 2=[1-5] 3=[6-10] 4 [Above 10]	<input type="checkbox"/>

8	Highest level of education attained	1=Less than primary 2= Completed primary 3=Completed o-level 4=Completed A-level 5=Completed tertiary institution certificate level 6=Ordinary Diploma 7=Advanced Diploma 8=Bachelor's Degree 9=Postgraduate Diploma 10=Master's Degree 11=PhD	_
9	Number of dependants in the household	1=None 2=1-2; 3=3-5; 4=6-8 5=More than 9	_
10	Are all dependants registered (have birth certificates)	1=No 2=Yes 3=Not sure	_
11	If yes to 8, how did you obtain the certificate	1=From Home 2=From hospital 3=From sub-county 4=From District 5=From NIRA Kampala 6=Other specify.....	_
12	How did you register for it?	1= Via phone 2=Via paper form 3=Via computer	_

Pre-usage citizen variables

Sample pre-usage evaluation tool for citizen perception about a computer-based system use.

Respond to the following items on a scale of 1. Strongly Disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly Agree

I think that I would like to use this system frequently	1	2	3	4	5
I think the computer system is not so complex	1	2	3	4	5
I think the system is easy to use	1	2	3	4	5
I need support from another person to submit the form	1	2	3	4	5
I think that the functions of the system are well integrated	1	2	3	4	5
There are might not be too much inconsistencies in a computer system	1	2	3	4	5
I imagine that most people can learn to use the system on their own like I can as well	1	2	3	4	5
I guess the system is not very cumbersome to use	1	2	3	4	5
I feel very confident using the computer system	1	2	3	4	5
I need to work with somebody technical before I can get to use a computer system	1	2	3	4	5

Appendix 5: FGD Problem discovery pilot phase and research tool testing among case unit 2 (rural hospital)



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Information Sheet and FGD tool

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Project brief

My name is **Stephen Kyakulumbye**, a student at the University of the Western Cape (South Africa) pursuing a Doctor of Philosophy (PhD) in Information Systems at the Department of Information Systems Faculty of Economic and Management Sciences. I am conducting a study aimed at designing a feasible e-government to citizen co-design framework for developing contexts among marginalised rural communities This study is solely for academic purposes. However, the results of this research will be shared with the Ministry of Information and Communications Technology; concerned local government to citizen service delivery through technology. Your personal details shall remain strictly confidential and anonymous, and the study does not intend to harm you in any way. I thank you in advance for your participation.

Purpose of the Study

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Procedures

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Potential Risks and Discomforts

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Letter of Consent FGD for problem discovery pilot phase among case unit 2-Rural hospital

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
A	I agree to participate in this research project.	
B	I have read this consent form and the information it contains and had the opportunity to ask questions about them.	
C	I understand that I was selected to participate in this study due to my [expertise/position] (<i>delete as applicable.</i>)	
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Focus Group Discussion (FGD) for citizens

General questions

Focus group discussion from stakeholder meeting (number of participants=40)

Part one: Guided tour of the hospital led by the medical superintendent. Stakeholders were asked to think aloud, empathise those who cannot pay for health services and cannot afford other services due to high poverty levels.

Part two: From an agreed consultative meeting of selected community group representatives (cyclists, drivers, religious leaders, Village Health Teams and Community outreach staff among others), 40 participants grouped into 5 group discussions of 8 each were all requested to answer the two questions below which were later presented and discussed at a plenary:

- a) How can we make the hospital the preferred hospital of choice to citizens in Central region of Uganda, Uganda and East Africa?
- b) What can the hospital put in place electronically, if any in order to improve service delivery to the indigent patients who cannot even provide medical care for themselves it serves while maintaining high level of quality at the same time?

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Appendix 6 a): Pre-system usability citizen questionnaire (Used among citizen owners of SMME case unit 3 refined after pretest)



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Letter of Consent Pre-system usability questionnaire for citizens

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Researcher: Stephen Kyakulumbye

By checking the box,		√
A	I agree to participate in this research project.	
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Pre-system usability questionnaire

Part one: Demographic data

<p>INSTRUCTIONS: This tool has been developed considering the issues related to services you may require from government and services required to be delivered to citizens. They may be statutory/mandatory, necessity to citizens and yield explained or direct observable benefits. The purpose of this study is to design an e-government design process for citizens taking a participatory approach. Please enter code in data entry column tick the most appropriate answer in section one and offer open free dialogue in the following sections. Additional instructions are provided in italics. In the event that additional information is required, you will be informed accordingly. Once completed, submit the questionnaire back to the facilitator.</p>			
SECTION ONE: PERSONAL INFORMATION			Data Entry
1	Participant code number		
2	Participant National ID Number (<i>optional</i>)		
3	Gender of Respondent (<i>circle one number</i>)	1 = Female 2 = Male	<input type="checkbox"/>
4	Age of Respondent (<i>write it</i>)		<input type="checkbox"/>
5	Business livelihood means (<i>state e.g. carpenter...</i>)		<input type="checkbox"/>
6	Marital status	1.=Single 2= Married 3=Divorced 4= Widowed	<input type="checkbox"/>
7	Highest level of education attained	1=Less than primary 2=Completed o-level 3=Completed A-level 4=Completed tertiary institution certificate level 5=Ordinary Diploma 6=Advanced Diploma 7=Bachelor's Degree 8=Postgraduate Diploma 9=Masters Degree 10=PhD	<input type="checkbox"/>

8	Have you ever used ICT in your business	1. No 2. Yes If Yes, specify.....	<input type="text"/>
9	Have you ever used ICT in any other form?	1. No 2. Yes If Yes, specify.....	<input type="text"/>

Pre-usage citizen variables

Sample pre-usage evaluation tool for citizen perception about a computer-based system use.

Respond to the following items on a scale of 1. Strongly Disagree 2. Disagree 3. Not sure 4. Agree 5. Strongly Agree

		1	2	3	4	5
10	I think using system can improve my business	1	2	3	4	5
11	Use of a computer system can improve my well being	1	2	3	4	5
12	Computer use is not a mere wastage of time	1	2	3	4	5
13	I think the computer system is not so complex	1	2	3	4	5
14	I think I would like to use a computer system frequently	1	2	3	4	5
15	I think I can gain something from the use of computers	1	2	3	4	5
16	I imagine that most people can learn to use the computer system	1	2	3	4	5
17	I do not feel very confident using the computer system	1	2	3	4	5
18	I think the computer system is not easy to use	1	2	3	4	5
19	I need support from another person to use a computer system	1	2	3	4	5
20	I need to work with somebody technical before use	1	2	3	4	5
21	There might be too much inconsistencies in a computer system	1	2	3	4	5
22	I think the functions of the computer system are not well integrated	1	2	3	4	5
23	I guess the computer system is very cumbersome to use	1	2	3	4	5

Appendix 6 b): User requirements interviews



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For Any Questions (FAQs)

If you have any questions feel free to contact me, the researcher. My phone number is SA. +0634474127 Ug. 0772492843 and my e-mail address is 3759606@myuwc.ac.za or kyakusteve@yahoo.com

If you have any questions that need direct university response pertaining this research study, please contact my supervisor Professor Shaun Pather at The Department of Information Systems, University of Western Cape. His telephone number is +27(0)84665556 and email is spather@uwc.ac.za OR the co-supervisor Dr Mmaki Jantjies at mjantjies@uwc.ac.za.

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Letter of Consent User requirements interviews with citizens

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
A	I agree to participate in this research project.	
B	I have read this consent form and the information it contains and had the opportunity to ask questions about them.	
C	I understand that I was selected to participate in this study due to my [expertise / position] (<i>delete as applicable.</i>)	
D	I agree to my responses being used for education and research on condition my privacy is respected. I understand that my responses will be used in aggregate form only, so that I will not be personally identifiable.	
E	I understand that I am under no mandatory obligation to take part in this project.	
F	I understand I have the right to withdraw from this project at any stage.	
G	I understand that this research might be published in a research journal, policy brief or book. In the case of dissertation research, the document will be available to readers in a university library in printed form, and possibly in electronic form as well.	

Name of the Participant.....Signature.....Date.....

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3759606@myuwc.ac.za Website: www.uwc.ac.za

User requirements interviews

The following were sample question but subject to further probing during the interview sessions:

- a) What factors underpin ICT usage among citizens in SME sector in Uganda?
- b) How would ICT be used to improve SME sector and citizens in general?
- c) What do envision as benefits of ICTs that would increase your interaction with government?
- d) What government services do you find to access that ICT would help you to reach out to government and other public servants?
- e) What are salient issues that this community needs to be reported to government officials in a very timely manner?



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Appendix 7 (a): Empathetic participatory design (Repertory Grid Technique schedule)



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Information Sheet (Repertory Grid Technique)

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Project brief

My name is **Stephen Kyakulumbye**, a student at the University of the Western Cape (South Africa) pursuing a Doctor of Philosophy (PhD) in Information Systems at the Department of Information Systems Faculty of Economic and Management Sciences. I am conducting a study aimed at designing a feasible e-government to citizen co-design framework for developing contexts among marginalised rural communities. This study is solely for academic purposes. However, the results of this research will be shared with the Ministry of Information and Communications Technology; concerned local government to citizen service delivery through technology. Your personal details shall remain strictly confidential and anonymous, and the study does not intend to harm you in any way. I thank you in advance for your participation.

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Letter of Consent for Repertory Grid Technique

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Researcher: Stephen Kyakulumbye

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Repertory Grid Interview schedule process

Phase one: Preliminary design using paper prototypes and expressive user persona simulation

Instructions:

- a) Groups design prototypes from the expressive user persona scenarios of the available problems
- b) The problems prototyped are: fire reporting, kidnap, theft and robbery reporting and rural transportation booking. The applications were: QuickApp, APB App, FindMe App and UBus App (all these are citizen-centric related online reporting applications for Fire, Accidents, Kidnapping and Transport booking in a rural setting respectively).
- c) Repertory Grid Technique process (selection, triading, laddering, rating and analysis)
 - i) **Selection:** Team members draw up the grid using the initial prototype set. Each person works independently with the selected set of prototypes. These are written on participants sheets. The element pool helps to identify constructs from which other elements are later rated. A role list that comprises of short sentences or phrases (one for each element) is used to describe typical elements in a domain.
 - ii) **Triading:** Team members select three elements randomly in order to give each element an equal chance of selection and avoid bias. Team members are asked to identify how two of the three examples are different from the third. There is no starting point provided, but participants are asked about the constructs that are important from their own perspective. Once the participant identified a construct, or how two prototypes are different from the third, the participant is asked to name the two polar opposites of the construct e.g. good or bad, and then writes the two contrasting poles at the opposite ends of a row in the grid shown below:

Elements	QuickApp	APB App	UBus App	FindMe App	
Constructs here (Bi-polar)	Rating	Rating	Rating	Rating	Opposites of the constructs (Bi-polar)
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	
	Rating	Rating	Rating	Rating	

- iii) **Rating and laddering:** Each team member rates the constructs elicited on a seven point Likert scale (1-least important through 7=most important). Laddering helps the team members to give justifications why one elements is contrasted from the two or why the two are similar yet different from the third.
- iv) **Analysis:** The results of the Repertory Grid are analysed both quantitatively (in numbers) and qualitatively using Atlas Ti qualitative data analysis programme. The participants, through participatory action learning develop a 'factor tree analysis' or 'dendrograms' or

affinity diagrams to cluster elements, their constructs and ratings. This allows for the ranking of the prototypes. The ranking was on a scale of 1-7.

- v) The grids resulted into the refinement of the artefact closed-ended questionnaire presented in appendix 7.

Appendix 7 (b) Empathy exercises with co-design participants

- a) The Dress Duration 15 minutes

Focus: Perspective taking: Showing the team the picture of a dress and asking them what colour it is. Is it blue, black, white, gold etc?

Outcome: Even things we consider unchangeable in the way they are perceived-like-colour-can be seen totally differently by different people.

Some debate for a while about why people perceived the dress differently.

Some questions to the group.

- How did you feel about those who saw the dress the same way as you?
- How did you feel about those who saw the dress differently?
- Point out that when this phenomenon occurred, people even put themselves into “Teams” on social media – Team Blue/Black and Team White/Gold. What are the implications of this?
- Can you think a situation in real life when someone saw a situation differently to you? Were you likely to think they were outright wrong? Is it possible that you were wrong, or neither of you were wrong?

Debrief: If something we all view as being universal between us – like our ability to perceive colour – is actually not universal at all, this has big ramifications for our interactions. Part of being empathetic is the ability to bridge differences in perception, even if another person’s point of view is radically different to yours. Today, as you speak to your customers, think about the ways that you can relate to, rather than isolate others despite differing opinions. Understanding that others have a right to see things differently can make all the difference in helping people feel respected, listened to and understood.

- b) Thoughts, feeling, behaviour Duration 20 minutes

Focus: Self-awareness and positive thinking

It can be very useful for helping a team become more aware of the impact of their thoughts, feelings and behaviour on themselves and their customers.

Split your team into pairs and ask them to discuss the last time they experienced feeling angry, overwhelmed, upset, or a similar emotion. Give them 5 minutes to share stories.

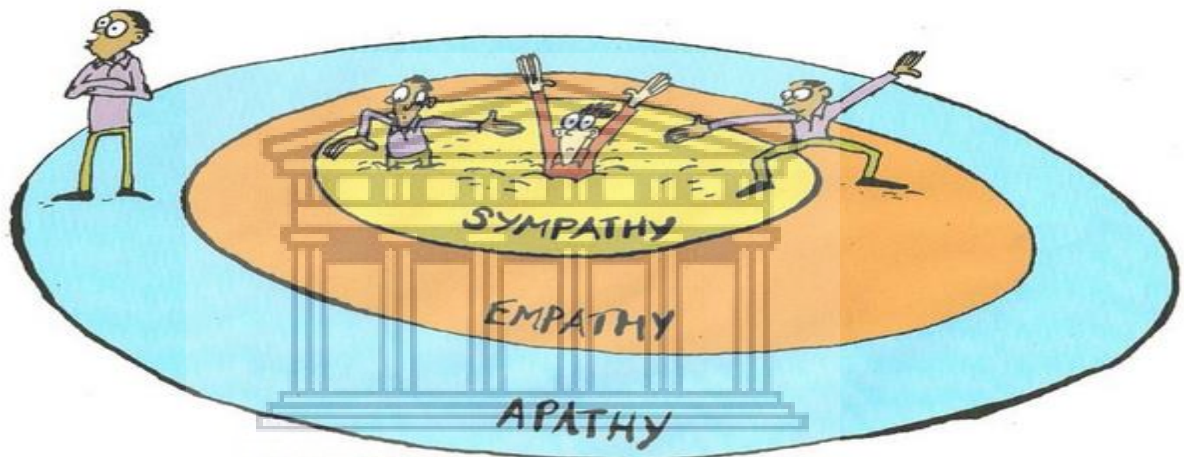
Draw up the thoughts / feelings / behaviour cycle on a whiteboard or flipchart and explain that the three influence each other. The cycle can continue or get worse if none of these three things change.

Debrief: Self-awareness is one of the building blocks of empathy. By being able to understand the links between the thoughts you have, the way you feel, your behaviour and its impacts on a situation, you begin to look at yourself objectively and give yourself the power to break the cycle. Understanding the way these things are connected in yourself also helps you to relate to the varied reasons why a person might be behaving negatively and help them find solutions to change their behaviour, challenge their thoughts and ease their feelings.

c) Stuck in quicksand Duration 20 minutes

Focus: Empathy and communication

Gather your team and explain that for any given situation another person is experiencing, we can respond to them with empathy, sympathy, or apathy. Show them the following diagram, or if you like, draw it up on a whiteboard or flipchart. Show them the following diagram, or if you like, draw it up on a whiteboard or flipchart.



Explain to the team: Imagine that you come across a person stuck in quicksand.

Apathy in this situation would be standing back and not caring, leaving the person stuck.

Sympathy in this situation is a response that acknowledges the other person's situation but doesn't consider it from their point of view. It doesn't help the situation, or even makes it worse. A sympathetic response to the quicksand situation would be to tell the other person that you'll help but then leap heroically into the quicksand, without thinking that you might also get stuck.

An empathetic response would be to relate to the person's situation and think deeply about what could be helpful for them, if you were in their position. For the person stuck in the quicksand, you might want to think about carefully pulling them out while being aware of your own safety or calling 911 and staying with the person until you are sure they are safe.

Debrief: Wrap up the session by asking your team to consider the ways they try to show empathy. Are their methods truly empathetic? Is sympathy easier for a lot of us? Challenge them to try some different things in their communications to show they are really putting themselves in their customer's shoes.

Appendix 8: Empathetic participatory design (Artefact evaluation questionnaire)



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Information Sheet (Artefact evaluation questionnaire)

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Letter of Consent for artefact evaluation questionnaire

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gaps.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
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Artefact evaluation questionnaire

Part one: Demographic data

<p>INSTRUCTIONS: This tool has been developed to assess awareness towards the designed system. The purpose of this study is to ensure that the designed new products are in line with your wishes, aspirations, expectations and thoughts. You are not obliged to answer a question that your feel causes you emotional stress. In other words, withdraw is at any time granted.</p>			
SECTION ONE: PERSONAL INFORMATION		Data Entry	
1	Interviewer name		
	Reg. no		
	Prototype Name		
2	Livelihood means (<i>Write it</i>) when <i>NOT</i> at university		
3	Gender of Respondent (<i>circle one number</i>)	1 = Female 2 = Male 3=Other	<input type="text"/>
4	Age of Respondent (<i>tick in brackets</i>)		<input type="text"/>
5	Age (<i>write it</i>)		<input type="text"/>
6	Marital status	1.=Single 2= Married 3=Divorced 4= Widowed 5=Rather not say	<input type="text"/>
7	Ever used a desktop computer system? (<i>Tick Appropriately</i>)	1= [No] 2=[Yes]	<input type="text"/>

8	Ever used a mobile application system? (Tick Appropriately)	1= [No] 2=[Yes]	____
9	Any other level of education attained apart from ordinary and high school e.g. short course (Name it)		____
	Where you or have you ever been involved in the design of any computer application?	1. No 2. Yes	
	If yes, mention it.		

Respond to the following items on a scale of:

'1' Strongly Disagree	'2' Disagree	'3' Indifferent	'4' Agree	'5' Strongly Agree
				

Perception design evaluation items: affordances, consistency, familiarity, recognizability, visibility						
10	The colours attracted my attention	1	2	3	4	5
11)	Colours can even be seen from a far	1	2	3	4	5
12)	The icons are visible enough	1	2	3	4	5
13)	The icons/pictures are understandable	1	2	3	4	5
14)	The words written are easy to understand	1	2	3	4	5
15)	I can easily recall information on the system	1	2	3	4	5
16)	The parts or functions are well integrated	1	2	3	4	5
17)	Instructions are short enough and simple	1	2	3	4	5
18)	Useful information is easy to find	1	2	3	4	5
19)	The colours attracted my attention	1	2	3	4	5
20)	Colours can even be seen with a naked eye	1	2	3	4	5
21)	The icons are visible enough	1	2	3	4	5
Comprehension design evaluation items: association, generalization, learnability, informative, ease of use						
22)	The system is easy to use	1	2	3	4	5

23) The system can even be used easily by novice users (first time users)	1	2	3	4	5
24) System labelling is useful for novice users	1	2	3	4	5
25) The information displayed on the system is easy to understand	1	2	3	4	5
26) The system is easy to learn	1	2	3	4	5
27) The system is informative	1	2	3	4	5
28) Short notes offer quick guidance	1	2	3	4	5
29) It easy to recall possible consequences that could happen	1	2	3	4	5
30) The system is safe to use	1	2	3	4	5
31) It is easy to use all applications of this nature on other phones	1	2	3	4	5
Projection design criteria items: feedback, meaningful, prediction					
32) System can guide me to give positive response while using it	1	2	3	4	5
33) It is easy to predict system fault	1	2	3	4	5
34) I can easily tell if the system is towards getting faulty	1	2	3	4	5
35) Faulty message can pop up to alert me of any problems	1	2	3	4	5
36) The symbols or icons used to not lead to any confusion	1	2	3	4	5
37) Symbols are clear to guide me how the system works	1	2	3	4	5
38) I can easily have quick analysis on the next actions using system feedback	1	2	3	4	5
39) I can easily have quick analysis on the next actions using system guidelines	1	2	3	4	5
40) I can easily have quick analysis on the next actions using pop up messages	1	2	3	4	5
41) I can easily have quick analysis on the next actions using system auto correction work	1	2	3	4	5
42) I can easily have quick analysis on the next actions using auto short notes	1	2	3	4	5
43) The system attracts user attention	1	2	3	4	5
44) The system can be used smoothly without problems	1	2	3	4	5
45) As I intend to lose focus, the system has hints to take be back to previous steps	1	2	3	4	5
Participatory Learning, knowledge acquisition and technology appreciation					
46) My knowledge and technology appreciation were from the time problem discovery	1	2	3	4	5
47) My knowledge and technology appreciation were from the time problem definition	1	2	3	4	5
48) The use of group discussion was most interesting on my side	1	2	3	4	5
49) I mostly enjoyed use of roleplays and action demonstrations	1	2	3	4	5
50) Use of paper demonstrations was my most interesting learning activity	1	2	3	4	5

51) I liked use of cartoons/stick pictures	1	2	3	4	5
52) Cartoons were of most interest for me to know about computer use	1	2	3	4	5
53) Text drawings were well used and were appealing to me	1	2	3	4	5
54) Real hands on computer practice made me like computer use most	1	2	3	4	5
55) I would like to use the system because of its design functionalities	1	2	3	4	5



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Appendix 9: From Empathetic participatory design to field usability experiencing (Artefact usability experiencing interview schedule)



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Information Sheet (Artefact usability experiencing interview schedule)

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The right to withdraw and to remain in the project

You may withdraw at any time without consequences of any kind. You can also refuse to answer any questions that you don't want to answer in the interview and still remain valued in the project.

Identification of the researcher and members of the research team

The contact details of the principal researcher and the identities of other designated members of the research team (data collection team if any) will be known to you and you may feel free to contact any of me or the supervisors directly at any time you wish to if you have questions relating to your participation in the participatory action research project.

For Any Questions (FAQs)

If you have any questions feel free to contact me, the researcher. My phone number is SA. +0634474127 Ug. 0772492843 and my e-mail address is 3759606@myuwc.ac.za or kyakusteve@yahoo.com

If you have any questions that need direct university response pertaining this research study, please contact my supervisor Professor Shaun Pather at The Department of Information Systems, University of Western Cape. His telephone number is +27(0)84665556 and email is spather@uwc.ac.za OR the co-supervisor Dr Mmaki Jantjies at mjantjies@uwc.ac.za.



Letter of Consent for Artefact usability experiencing interview schedule

PhD Title: “*Framework for developing citizen-centric e-government applications in developing countries: The design-reality gap.*”

Researcher: Stephen Kyakulumbye

By checking the box,		√
A	I agree to participate in this research project.	
B	I have read this consent form and the information it contains and had the opportunity to ask questions about them.	
C	I understand that I was selected to participate in this study due to my [expertise/position] (<i>delete as applicable.</i>)	
D	I agree to my responses being used for education and research on condition my privacy is respected. I understand that my responses will be used in aggregate form only, so that I will not be personally identifiable.	
E	I understand that I am under no mandatory obligation to take part in this project.	
F	I understand I have the right to withdraw from this project at any stage.	
G	I understand that this research might be published in a research journal, policy brief or book. In the case of dissertation research, the document will be available to readers in a university library in printed form, and possibly in electronic form as well.	

Name of the Participant.....Signature.....Date.....

For Any Questions (FAQs)

If you have any questions feel free to contact me, the researcher. My phone number is SA. +0634474127 Ug. 0772492843 and my e-mail address is 3759606@myuwc.ac.za or kyakusteve@yahoo.com

If you have any questions that need direct university response pertaining this research study, please contact my supervisor Professor Shaun Pather at The Department of Information Systems, University of Western Cape. His telephone number is +27(0)84665556 and email is spather@uwc.ac.za OR the co-supervisor Dr Mmaki Jantjies at mjantjies@uwc.ac.za.



Artefact usability experiencing interview schedule

Role of this exercise (phase):

This is a visual representation of your prototype to the user in the formation and development of ideas in your design process. It is an extension of “mental imagery” of your user. By visualising user thoughts about aspects of your project, you (designers) want to expand the problem space of the task, to the extent of including and even discovering, new aspects from user’s point of view. This thinking in multiple perspectives about future possibilities is difficult to conduct by purely internal mental processes; you the designer needs to interact with an external representation. Therefore, visualising ideas through sketching and system simulation “provides a temporary, external store for tentative ideas, and supports the “dialogue” that the designer has between problem and solution.”

General instructions

- a) We share roles: User must have hands-on experience while one of the designers takes on role of the instructor, some observers, others note takers, others alternative instructors to bridge the questioning and response gap between the user and designer instructor.
- b) We need to practice and rehearse as a group before approaching the potential users
- c) We shall interview between 3-5 users based on persona (unit of analysis) mainly drawn from the SMME sector from whom the problem was discovered.
- d) We need to be as positive and open minded to the user as possible, do not over argue the user because you have your perspective and the user has his/hers
- e) Ensure that our user has hands on and your work is to guide him/her during the simulation process of user interfacing
- f) Observe any difficulties and ensure that these are documented for future prototype refining
- g) Allow and prompt the user to ask as many questions as s/he wants about your prototype
- h) Be sure to ascertain that you do not over burden the user with benefits of use of your prototype BUT s/he should discover such benefits. You want to discover whether the user has similar thoughts about application relevancy as you thought as a group
- i) Explore alternative problems from the user’s perspective for any possible future design
- j) Rate user’s problem perspective to yours and weigh which is more important. If the user appreciates the problem you are solving in what you are designing, then well and good.
- k) Some few prompts/issues from the questionnaire you filled while we were prototyping in class can guide you to ask users some questions as a way breaking silence between your team and the user (perception questions, comprehension questions and projection questions). Do not ask too much as we need users’ input most at this phase.
- l) The following ten-point interview process can guide you but can be somehow adjusted if you feel like BUT it should be real usability testing through the simulator
- m) You can have group reflections as you finish an interview with a user so that you document item/process number 10 to refine better way of usability experiencing for another respondent
- n) The whole reflections should be documented in this template provided below; however, you can attach explanatory notes and findings if you feel this template is not enough.
- o) One interview cannot last more than 45 minutes (30 minutes to 45 minutes is sufficient)

1. Interview (..... MINUTES): Building rapport (Introduction: Initiating the interview process). Group introduction of team members i.e. we are from and some brief about what you are trying to come up with. User should ask you much as s/he can about your problem issues. You want to explore whether user could have had an alternative problem (Do not go deep to explaining the problem, it's in the next phase interview 2).

Notes from first iterative interview



2. Dig deeper (.....minutes second interview about the problem domain of the participant). Also a real design challenge case study is presented. In our first meeting, community

members proposed..... We came up with three alternatives but we have.....while our colleagues have.....

Notes from second iterative interview



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Capture findings: User's and designers perspectives MINUTES

User and designers: things they are trying to do based on case explanations* Use of verbs

Researcher/designer insights: New learning about interviewees feelings, aspirations, worldview to leverage design* *inference is made from what was **heard, observed and felt**



**4. Define the problem statement (Notes from second and findings in third interview)
MINUTES**

Owner needs: things they are trying to do based on discussions * Use of verbs

Problem description based on user perspective

Needs a way to _____

User need

Surprisingly//because //but.... –any more relational phases within dialogue (need explanation)

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Insight

User needs: things user is trying to do based on dialogue* Use of verbs

Problem description based user

Needs a way to _____

Surprisingly//because //but.... –any more qualitative relational phases within dialogue (need explanation or impediment or what is done so far)



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Insight

6. About the problems we are contributing solutions

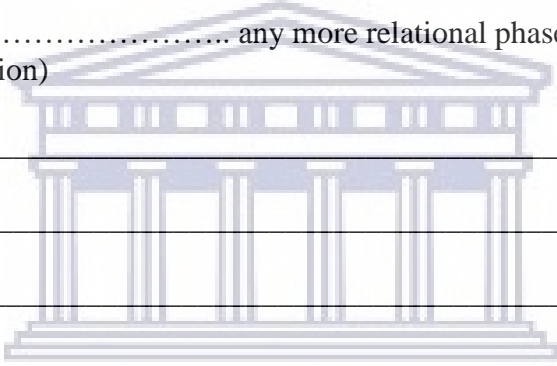
Whereas the user needs.....based on things s/he trying to do based on dialogue* Use of verbs

Problem description based on citizen perspective

Needs a way to _____

Citizen need

Our App is a way to any more relational phases within dialogue (need explanation)



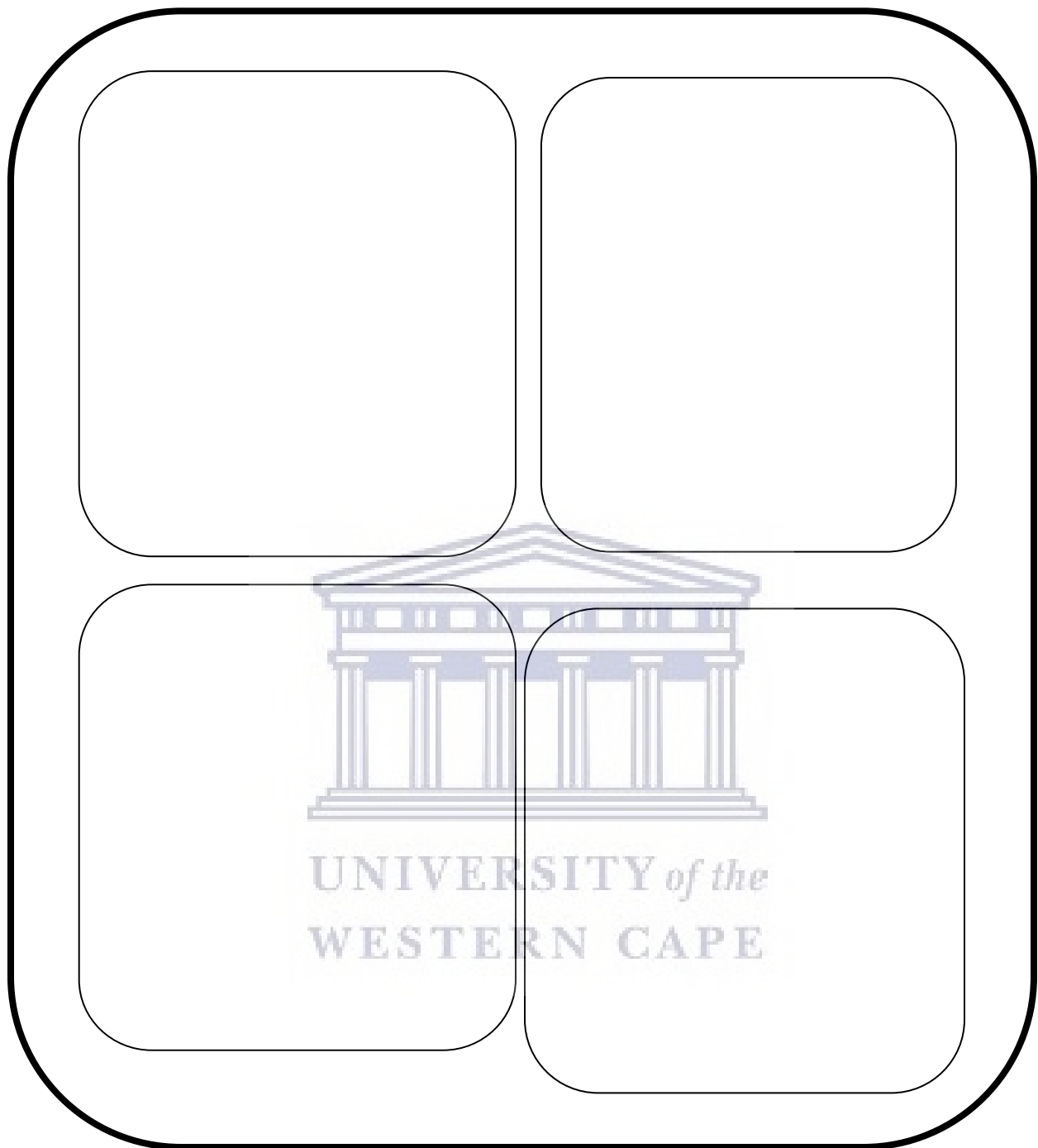
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Further Insight (initial scoping)

e;

Usability issues can be written based on the perception and perspective of user (You can add supplementary notes if this is not enough for your write up)



The form consists of a large outer rounded rectangle with a thick black border. Inside this rectangle, there are four smaller rounded rectangles arranged in a 2x2 grid, each with a thin black border. These rectangles are intended for writing usability issues. In the center of the grid, there is a faint watermark of a classical building with columns and a pediment, with the text "UNIVERSITY of the WESTERN CAPE" below it.

8. Clarify user persona, scenarios, you can have some spontaneous mock up role demos for user; capture feedback MINUTES

Notes:



9. Reflect and document more user issues of your app and request for input and questions about current and future use in case the user remained to use your App without your support as much as possible MINUTES

Sketch big idea and note details where necessary!



10. Continue prototyping process until you go through your interfaces and ensure that difficult in usability are documented. Document any alternative problems that need to be designed based on user's perspectives MINUTES

Write your reflective notes with user here and any other problems or requirements needed to be designed if any



11. Write the testing (user experiencing notes) (Can mark an end) MINUTES

✓ What worked.....and why??

___ What could be the alternative and why?

? Questions.....for clarity

! Ideas to incorporate....

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Appendix 10: Clearance letters for data collection

a) University of the Western Cape Ethical Clearance



OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
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www.uwc.ac.za

05 December 2017

Mr S Kyakuhumbwe
Information Systems
Faculty of Economics and Management Sciences

Ethics Reference Number: HS17/10/38

Project Title: A framework for developing citizen-centric e-government applications in developing countries: The design-reality gap in Uganda.

Approval Period: 17 November 2017 – 17 November 2018

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

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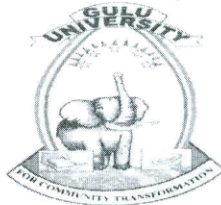
Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER - 130416-049

b) Data collection geographical location clearance from Uganda as a statutory procedure (*National Guidelines for Research Involving Humans as Research Participants, 2017*)

i) Gulu University Ethical Clearance Committee

GULU
P.O. Box 166 Gulu Uganda
Website: www.gu.ac
Email: lekobai@gmail.com



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Mob: +256772305621

RESEARCH ETHICS COMMITTEE

15th Jan 2018

APPROVAL NOTICE

To: Mr. Kyakulumbye Stephen
Principal Investigator
University of the Western Cape
South Africa

Re: Application No. GUREC-001-18

Type of review:

- Initial review
 Amendment
 Continuing review
 Termination of study
 SAEs
 Other, Specify: _____

Title of proposal: **“Developing citizen-centric e-government applications in developing countries: The design-reality gap in Uganda”** Version 2.0: 12th Jan 2018

I am pleased to inform you that your research proposal has been approved by the Gulu University Research Ethics Committee (**GUREC**).

Approval of the research is for the period of **15th Jan 2018 to 14th Jan 2019**.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the **GUREC** for re-review and approval prior to the activation of the



<http://etd.uwc.ac.za/> FACULTY OF MEDICINE
P. O. Box 166, Gulu

changes. The **GUREC** application number assigned to the research should be cited in any correspondence.

3. Any unanticipated problems involving risks to participants must be promptly reported to the **GUREC**. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for the **GUREC** review.
4. Only approved and stamped consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The **GUREC** may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. Therefore, a continuing review application must be submitted to the **GUREC** eight (8) weeks prior to the above expiration date of **14th Jan 2019** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely manner may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.
6. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following documents have been approved in this application by the **GUREC**:

	Document	Language	Version	Version Date
1	Protocol	English	Version 2.0	12 th Jan 2018
2	Data Collection Tools	English	Version 2.0	12 th Jan 2018
3	Informed consent Document	English	Version 2.0	12 th Jan 2018

Signed,

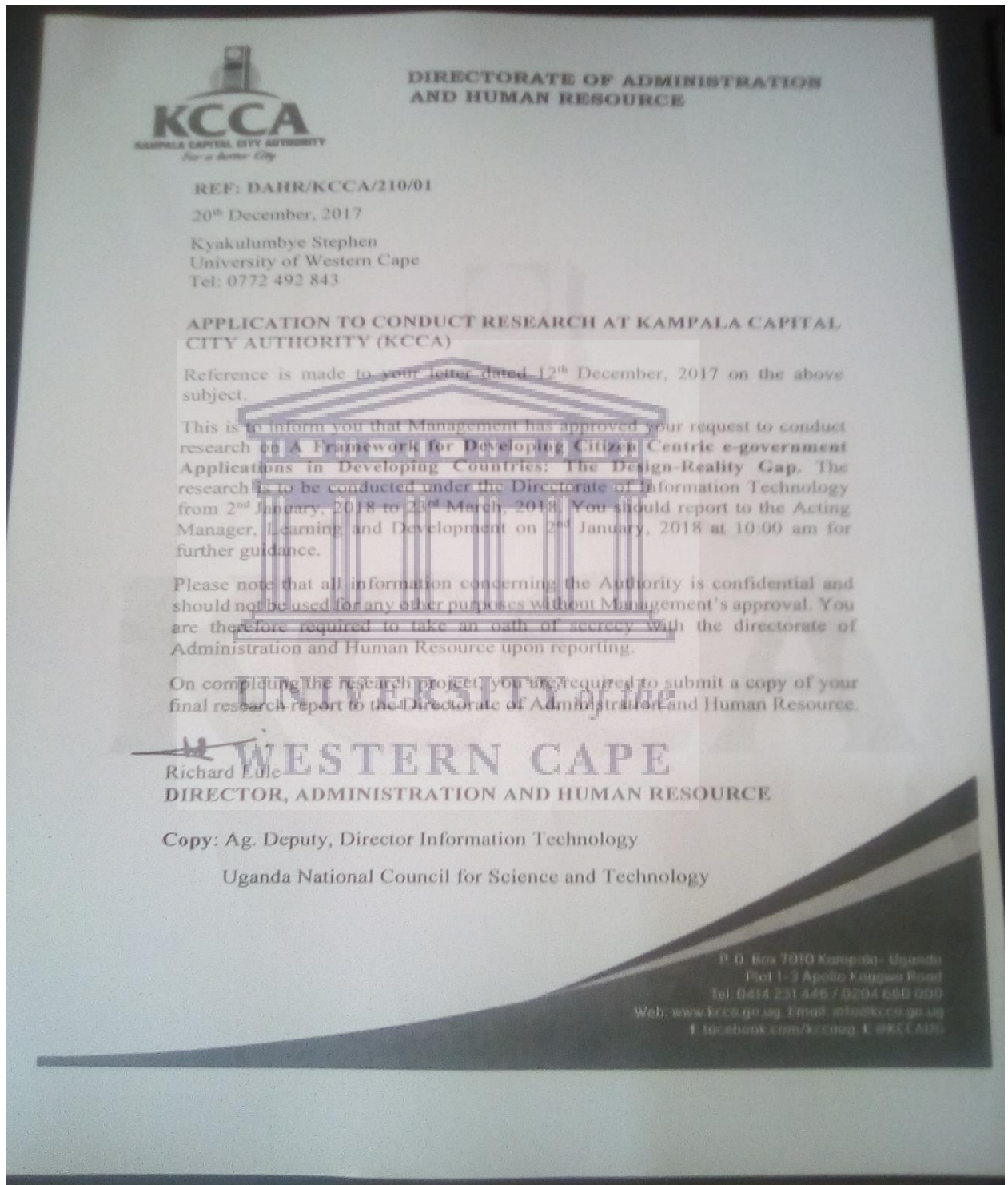


Dr. Gerald Obai
Chairperson

Gulu University Research Ethics Committee



i) **Kampala Capital City Authority**



ii) National Council for Science and Technology



Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Dear Stephen Kyakulumbye,

I am pleased to inform you that on 13/02/2018, the Uganda National Council for Science and Technology (UNCST) approved your study titled, **A framework for developing citizen-centric e-government applications in developing contexts: The design-reality gap**. The Approval is valid for the period of 13/02/2018 to 13/02/2020.

Your study reference number is IS9ES. Please, cite this number in all your future correspondences with UNCST in respect of the above study.

Please, note that as Principal Investigator, you are responsible for:

1. Keeping all co-investigators informed about the status of the study.
2. Submitting any changes, amendments, and addenda to the study protocol or the consent form, where applicable, to the designated local Research Ethics Committee (REC) or Lead Agency, where applicable, for re-review and approval prior to the activation of the changes.
3. Notifying UNCST about the REC or lead agency approved changes, where applicable, within five working days.
4. For clinical trials, reporting all serious adverse events promptly to the designated local REC for review with copies to the National Drug Authority.
5. Promptly reporting any unanticipated problems involving risks to study subjects/participants to the UNCST.
6. Providing any new information which could change the risk/benefit ratio of the study to the UNCST for review.
7. Submitting annual progress reports electronically to UNCST. Failure to do so may result in termination of the research project.

Please, note that this approval includes all study related tools submitted as part of the application.

Yours sincerely,

Hellen Opolot
For: Executive Secretary

Appendix 11. A list of e-government positions involved in the fieldwork interviews

Case unit 1

- a) Ministry of ICT office of the Minister-Personal Assistant to the Minister (1)
- b) Ministry of ICT office of the Permanent Secretary (1)
- c) Uganda Communications Commission-Technical Manager In Charge of Rural Communications Technology Fund (1)
- d) National Information Technology Authority-Policy and Planning office (1)
- e) National Information Technology Authority-Research and Development Office (1)
- f) Kampala Capital City Authority-Directorate of ICT
 - i) Officer Business Processing team under ICT department (1)
 - ii) Software Developers (2)
 - iii) Database Administrators (2)
 - iv) Application Developer (2)
- g) Uganda Communications Commission-In charge Mukono District Rural Communications Technology Project (1)
- h) Other district officials (12)

Case unit 2

- i) Pre-study: Stakeholders of St Francis Naggalama Hospital (40 FGD representative participants selected from village health teams, motorcycle riders, family protection units, tax drivers, religious leaders)
- j) Pre-study: Pre-system usage questionnaire administered among 25 selected staff from St. Francis Naggalama Hospital

Case unit 3

- k) SMME community of Mukono District interviews (Mukono Municipality) (90)
- l) SMME community of Mukono District questionnaire survey (425)

Case unit 4: Co-design team

The following formed the co-design team (intermediary team) (28)

QUICKAPP

1. Muchere Gaius
2. Angorit Esther
3. Namayengo Jackline
4. Musikamwine Arnold
5. Twine Bob
6. Okware Jones
7. Nahabwe Nicholas
8. Magarure Nelly

UBUS

1. Nabacwa Damali
2. Oluka Emanuel
3. Masiika Daphine
4. Adong Sandrah
5. Ahuura Sarah
6. Allen Ishabella
7. Kaire Muhammad



FINDME APP

1. Kimutai Lewis
2. Nimusiima Ignatius
3. Karamagi Nelson
4. Atuhair Bob
5. Aijuka Bless
6. Otim Jerome
7. Tukacungura Tarzan

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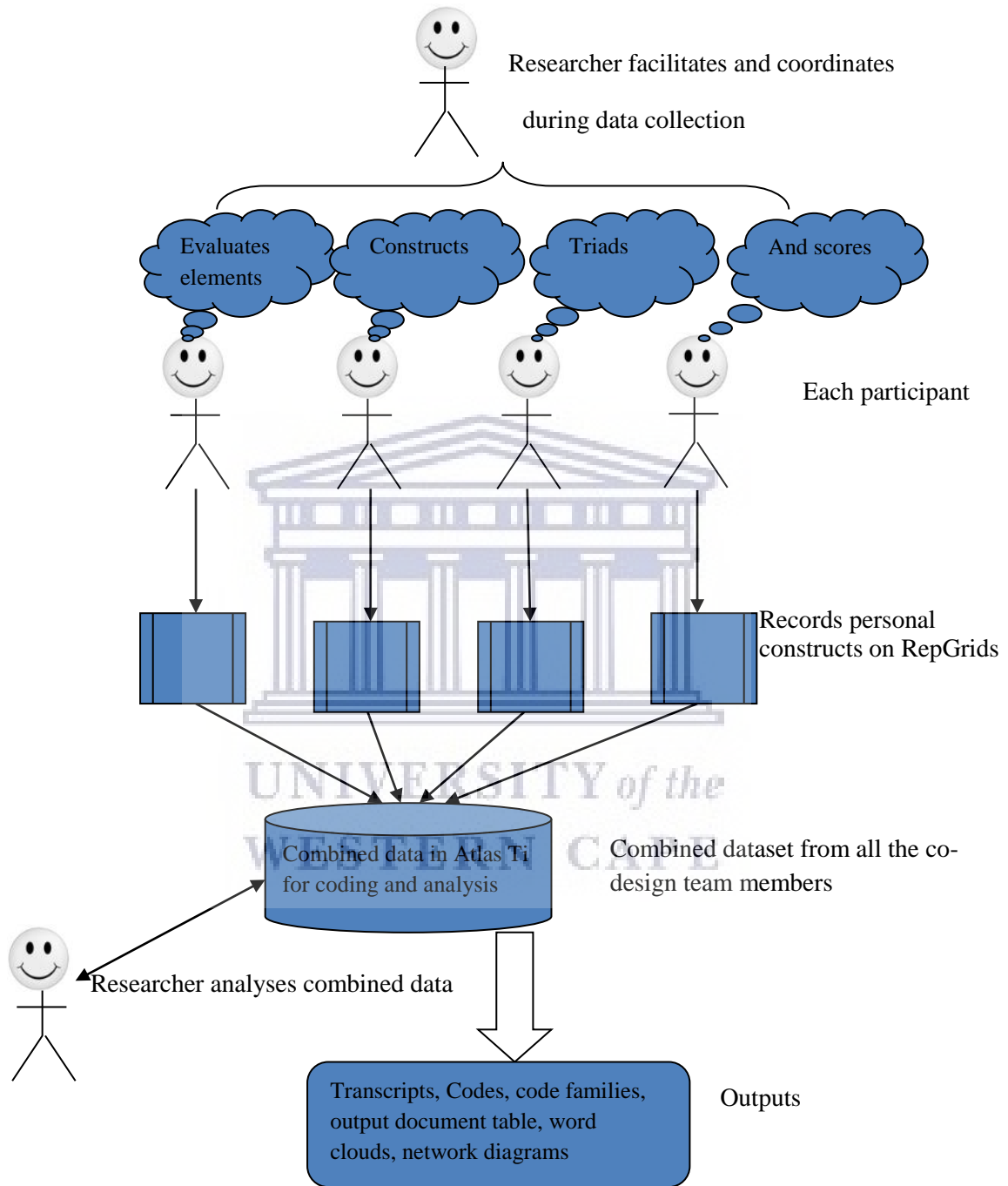
REPORTIT APP

1. Kwagala Glorious Isiko
2. Nabona Davis
3. Nankya Ivy
4. Joas Maheta
5. Kabano Alexandria
6. Kemigisha Mirielle

Appendix 12. A list of e-government policy documents reviewed

- a) Ministry of Finance, Planning and Economic Development. Budget call circular: Preparation of detailed budget estimates for the financial year 2013/2014; 2014/2015; 2015/2016; 2016/2017
- b) Uganda Communications Commission: Rural Communications Development Fund (RCDF) 2002/3-2013/14. 10 years of RCDF
- c) The Republic of Uganda. The Broadcasting Policy, 2005
- d) Strengthening the Ugandan Business Information Network II Establishment of 8 Pilot District Business Information Centres, United Nations Independent Organization UNIDO Project UE/UGA/04/062
- e) Bench marking e-government. A global Perspective-Assessing the progress of UN member states by United Nations Division for Public Economics and Public Administration; American Society for Public Administration
- f) International Telecommunications Union. E-government, an implementation tool kit, 2009
- g) The Republic of Uganda. Ministry of ICT. National Electronic Government Framework (e-Government Final Draft, 2010).
- h) The Republic of Uganda. Ministry of ICT. Annual Monitoring Report, Financial Year 2015/16
- i) The Implementation of Integrated Financial Information Management Systems (IFMIS), Uganda
- j) The Republic of Uganda. Ministry of ICT. Ministerial Policy Statement, 2016.
- k) The Republic of Uganda. Ministry of ICT National Information Technology Authority, 2012. e-Government Master Plan.
- l) World Summit of Information Society. WSIS + 10 High Level Event, 2014
- m) Ministry of ICT. National Information Technology Authority. Towards a Smart Uganda. Presentation by Executive Director NITA-U.

Appendix 13. Expressive user persona graphical representation of paper prototypes and repertory grids



Appendix 14. Atlas ti transcripts, codes and word clouds generated during citizen user experiencing

HU: APPS_INTERVIEW_DATA

File: [D:\UIVERSITY OF THE WESTERN CAPE PHD FILES\KYAKULUMBYE_PHD_FOLDER\NEW...\APPS_INTERVIEW_DATA.hpr7]

Edited by: Super

Date/Time: 2018-09-07 20:28:56

Code Family: CONTEXT RELATED ISSUES

Created: 2018-09-07 19:05:21 (Super)

Codes (41): [A lot of fire around] [A way to save money] [Advertising it to wider community] [Advertising the App] [Allow for more transactions we know of] [Alternative means of access] [Alternative ways of payments and bookings] [Another user group identified it] [Any application for seeking justice from government?] [App does not exclude between people profiles. All can use, young, male, female etc.] [App inclusiveness e-g disabled, pregnant women, elderly] [App is timely as police is not doing much] [Are pictures and videos enough evidence for police?] [Automatic as fire is very sensitive] [Building Rapport] [Can an 8-year-old kid read the location of parent? understandability] [Can it be accessed in an internet cafe] [Can it work online and offline?] [Can my IMEI number trigger that of police automatically without victim struggling to put it?] [Can prevent crime] [Can solve crime] [Categorise citizen users] [Catering for non-smart technology of the rural] [challenge to look for case file] [Circle members can respond to notifications] [comments from community on how fire started] [connection to GPS] [Consider more Apps for SMEs like bid submission] [Constant community workshops like this hands on to all citizens] [Context os use: visitor use has not seen fire gutting in Uganda] [Corruption will end up delaying your efforts] [Cub crime rates for girls] [Different classes of people need to be catered for] [does it work both online and offline?] [When no data bundles?] [Where can it be accessed?] [Work on universal use] [Working closely with more people during its implemmentation] [Works only online] [Yet internet is now taxed (OTT) tax] [You need to work with police to understand this useful App]

Quotation(s): 45

Appendix 15. Constructs Table

Sample constructs table for designing marginalised citizen-centric e-government applications			
<i>Target behaviour starting with citizens capable of contributing to community transformation, yet they are excluded. They include informal sector citizen owners, SME citizens, youths, women, grass root NGOs and CBOs.</i>	Use and adoption of designed citizen e-government services ranging from basic community welfare services, public safety, crime, hard-to-reach transport service bookings, to health solutions. These are some forms of basic services.	To mandatory citizen services like online birth registrations, national identification registration, death registration, passport application, driver's license application and renewals and others in similar category. This is prior to ensuring that citizens have self-efficacy and self-concept.	e-democracy, e-accountability, online participatory budgeting, e-voting, etc.
<i>Pre-usage beliefs and attitudes</i>	Learnability, benefits of use, cultural beliefs, complexity, user confidence, etc.		
<i>E-government service design</i>	Co-discover, co-define, co-develop, co-deliver. Have a theory of change in mind.		
<i>Evaluation criteria: situation awareness, mindfulness and context</i>	Perception: To build a mental model of the environment, it is necessary to gather sufficient and useful data by using our senses of vision, hearing and touch to scan the environment. We must direct our attention to the most important and relevant aspects of our surroundings and then compare what we sense with experience and knowledge. It is an active process that requires significant discipline, as well as knowing what to look for, when to look for it and why.		Mindfulness: Attend to what arises. Connect with it all Clear the mind of preconceptions
	Comprehension: Our understanding is built by combining observations from the real world with knowledge and experience recalled from memory. If we successfully match observations with knowledge and experience, we have developed an accurate mental model of our environment. This mental model has to be kept updated with input from the real world by paying attention to a wide range of information.		Embody the experience. Prevent premature judgment Attend to what arises
	Projection and thinking ahead: Our understanding enables us to think ahead and project the future state of our environment. This step is crucial in the pilot's decision-making process and requires that our understanding, based on careful data gathering, is as accurate as possible.		Trust emergence
	Context: Cultural, legal, social, economic, new problem domain context, environment/location and user profile.		Engage all mindfulness and situation awareness

Appendix 16: Evolution of the Philosophy of Science

Evolution of Philosophy of Science

Period	Scholasticism (a mind towards a traditional doctrine) and logos (logic behind an argument).	Description of the Philosophical traits of the period	Sources
5th and 4th Century B.C	Pre-Socratic philosophers (e.g. Thales, Enaximander)	<ul style="list-style-type: none"> • There was ‘muthos’ (a true story, a story that unveils the true origin of the world and human beings). • Affected the character of subsequent philosophy. • Aristotle’s documentation of Thales being the first “Material Monist” as explanation of the physical world by saying that all the world’s objects are composed of a single element. However, Thales observes, “They say that the earth rests upon water,” Cherniss, 1951. For Aristotle interpreted it as, “All things come to be from water,” (Cherniss, 1953) • Thales first declared souls to be immortal, all things are full of gods, soul ascribed to a magnet because it moves iron. • This period emerged to be the source of controversies in logos. Hence myths to logos (Adorno, 1999). 	<p>Cherniss, H., 1951</p> <p>Adorno, F., 1999</p> <p>Partenie, C. 2009</p> <p>Fieser, J. & Lillegard, N., 2002</p>
6th Century B.C	Aristotle, Plato, Socrates	<ul style="list-style-type: none"> • Myths were used as a widespread, popular belief that was false (Partenie, 2009). • Attempt to discover the world’s governing principles (metaphysics). Rational and logical explanations of the World. The birth of logic centrism (belief that pursuit of pure reason leads to discovery of the world hence logical reasoning/philosophy which is love for wisdom. Introduction of geometry, engineering, surveying, Pythagoras theorem (Cherniss, 1953). • Plato attempts to overcome the traditional opposition between muthos, myths and logos (Partenie, 2009). 	<p>Cherniss, H., 1951</p> <p>Adorno, F., 1999</p> <p>Partenie, C. 2009</p>
Middle Ages (Ancient Greek and Roman) 11th to	Saint Thomas Aquinas	<ul style="list-style-type: none"> • Medieval enquiries in medieval universities in Italy, England and France; intellectual renaissance, revival of mercantilism. • Combining Theology with Philosophy. 	<p>Scott, J.C., 2006</p>

14th Century		<ul style="list-style-type: none"> • Universal Roman church, secular governments, and municipalities required educated priests, administrators, lawyers, physicians, and clerks for business. 	Crosby, A.W., 2015
15th to 18th Century	Age of reason and age of enlightenment by John Lock, George Berkeley, Rene Descartes, Francis Bacon, Baruch Spinoza, Immanuel Kant, Steuart, J.	<ul style="list-style-type: none"> • Marked the Century of Philosophy where reason was the primary source authority and legitimacy; marked beginning of meetings at academic conferences. • Scientific revolution of modern science like Biology, Physics, Mathematics, Chemistry to transform society. • Rationalism reason rather than experience was the source of knowledge. • Emerged a challenge of rationalism by empiricism that all that can be known results from human sensory experience. • Kant tries to offer explanation for relationship between reason and human experience through his writing of “critique for pure reason.” Kant’s advancement of the view that perpetual peace could be secured through universal democracy. 	Redwood, J., 1976 Chan, S., 1997 Steuart, J., 1767
19th Century	<p>Idealism (elaboration of rationalism) and positivism (empiricism) by Auguste Comte (1798-1857)</p> <p>Idealism is a group of metaphysical philosophies that assert that reality is purely mental</p> <p>Kant’s transcendental idealism</p>	<ul style="list-style-type: none"> • Positivism with all that is observable and generalized laws by induction, Comte took his cue from Kant. • The world is made of ideas and therefore sense perceptions are sources of knowledge; materialism that world is matter; atomism that the world has atoms and empty space. • Kant’s transcendental idealism – as opposed to traditional idealism where Kant espouses that human experience of things is similar to the way they appear to us. 	Redwood, J., 1976 Chan, S., 1997 Viskovatoff, A., 2002
20th Century	Critique to positivism by Marx Weber under antipositivism also called interpretivism or negativism and critical theorists drawing from Kant and Marx use of the term critique	<ul style="list-style-type: none"> • Critical theorists held the view that reflective assessment and critique of society and culture needs applications of knowledge from social sciences and humanities. • Interpretivists advocated for subject research into values, norms, symbols and social processes. 	Viskovatoff, A., 2002 Keat, R., 1981
Middle 20th Century	Postmodernism (post structuralism) or strong constructivism) and postpositivism influenced by Philosophers like Thomas	<ul style="list-style-type: none"> • Postmodernism is the point of departure for works of literature, architecture, design as well as interpretation of law and culture. Postpositivists critiqued and amended positivism e.g. Martin Heidegger rejected the philosophical basis of "subjectivity" and "objectivity" and asserted that similar grounding oppositions in logic 	Viskovatoff, A., 2002 Keat, R., 1981.

	<p>Kuhn, Martin Heidegger</p> <p>Critical Realism by Roy Bhaskar</p>	<p>ultimately refer to one another.</p> <ul style="list-style-type: none"> • Bhaskar's critical realism lies at the ontological root of contemporary streams of Marxist political and economic theory. • Bhaskar is compatible with Marx's work in that it differentiates between an intransitive reality, which exists independently of human knowledge of it, and the socially produced world of science and empirical knowledge. 	<p>Martin, W., 1972</p> <p>Stepanich, L.V., 1991</p> <p>Cartwright, N., 1999</p> <p>Gross, A.G., 1990</p> <p>Sayer, A., 1997</p> <p>Mingers, J., 2004</p> <p>Bhaskar, R. and Callinicos, A., 2003</p>
21st Century	<p>Herbert Alexander Simon (1949-2001) with interdisciplinary research spanning fields of cognitive science, computer science, public administration, management, political science</p> <p>Benbasat and Zmud's (2003): IS discipline and IS research should be the IT artifact</p> <p>Tilley and Pawson (1997) have introduced Context Mechanism Outcome Configuration similar to our Proposed co-design theory of change for this stud.</p> <p>Other renowned information systems and adoption scholars: R. Heeks, S. Pather, Nunamaker Jr, Endsley, Ajzen, Fishbein, Babbie and Mouton</p>	<ul style="list-style-type: none"> • Design science research is a "lens" or set of synthetic and analytical techniques and perspectives (complementing positivist, interpretive, and critical perspectives) for performing research in IS. Design science research involves two primary activities to improve and understand the behaviour of aspects of Information Systems: (1) the creation of new knowledge through design of novel or innovative artifacts (things or processes) and (2) the analysis of the artifact's use and/or performance with reflection and abstraction. • IS viewed as a socio-technical discipline where context of design and use are critical and therefore research philosophies, paradigms, practices and activities must embrace such a worldview. • Critical realism can be best suited to underpin design science research because of its critical and emancipatory component. • Where there exists emancipatory tendencies of affected, the context mechanism outcome configuration of the realist social theory is critical. 	<p>Vaishnavi, V.K. and Kuechler, W., 2015</p> <p>Carlsson, S.A., 2007</p> <p>Simon, H.A., 1995</p> <p>Simon, H.A., 1996</p> <p>Newell, A. and Simon, H.A., 2007</p> <p>Simon, H.A., 1980</p> <p>Benbasat, I. and Zmud, R.W., 2003</p> <p>Pawson, R. and Tilley, N., 1997</p> <p>March, S.T. and Smith, G.F., 1995</p>

Appendix 17: Adoption theories related to e-government

Introduction

Information systems problems have been studied by drawing on several referent disciplines (Lewis, Agarwal & Sambamurthy, 2003; Nambisan, 2003), while at the same time working towards becoming a reference discipline (Wade, Biehl & Kim, 2006). This has been earmarked as a major objective of MIS Quarterly (Lee, 1999). This study drew from multidisciplinary theories from fields such as computer science, psychology, governance/public administration, and software engineering among others. As an information system domain study, whose body of knowledge is socio-technical in nature, it accepts encompassing multiple disciplines if a viable and feasible theory is to be proposed (Orlikowski & Baroudi, 1991; Chiasson & Davidson, 2005). This is supported by Davis (2000) who candidly reveals that a theory offers conceptual foundations for the field and study. There are three approaches to information systems conceptual foundations (Davis & Olson, 1984; Davis, 2000):

- a) An intersection approach that accepts any concept from any field if it appears to add insight and explanation to information systems practice and research;
- b) A core approach that seeks to define those ideas that characterise the discipline and make it distinct; and
- c) An evolutionary approach that seeks a cohesive set of concepts by combining the concepts from the core approach with concepts from other fields that over time are found to be especially useful to information systems (Davis & Olson, 1984; Davis, 2000).

This study incorporates elements of all three. The researcher reviewed a number of theoretical frameworks to ensure a justifiable alignment (intersection approach) while at the same time remaining within the confines of the information systems discipline (core approach) in order to generate evolving theoretical frameworks (evolutionary approach). These guiding theories are presented as models and others as frameworks. However, in this study, the researcher is mindful that in order to develop viable conceptual and theoretical foundations, information systems studies need to consider context as a key dimension in any system design endeavours (Delone & McLean, 2003; Venkatesh *et al.*, 2011). In the following sections, I briefly provide an

understanding of the concepts of theory, model and framework, thereby drawing this study's inclination.

Theories, Models and Frameworks

While there is overlap among the concepts of theories, models and frameworks, there is need to be aware of the differences so that an informed decision is made in selecting those that are relevant to the study domain and context. For instance, Nilsen (2015) and Von Bertalanffy (1972) conceptualise a theory as a set of analytical principles or statements designed to structure our observation, understanding and explanation of the world. A framework, on the other hand, usually denotes a structure, overview, outline, system or plan consisting of various descriptive categories (e.g. concepts, constructs or variables) and the relations between them that are presumed to account for a phenomenon (Dubois & Gadde, 2002). Frameworks can set forth avenues for describing creation of interventions by linking individuals, organizations' environment (context) and processes therein (Gartner, 1985). Based on Frigg and Hartmann's premise of model representation (2012), this study operationalises models in various ways but is dependent upon context for its use as follows:

- a) Representation function: The model is perceived as theoretical representation, concept representation and statistical representations.
- b) Ontology view: Models can represent the world at various layers and stratification.
- c) Epistemology view: How we learn from models how models relate to theory.

The extant literature reveals that theories, models and frameworks are imported from other disciplines while others are native within a given field of study.

Imported and Native Theories in General

There is an ongoing debate in the e-government theoretical literature that most theories relating to information systems in general and e-government in particular are "imported to the discipline and are not considered native. Bannister and Connolly (2015) have defined *imported theories* to mean the adoption or adaption of a theory from another field or discipline in e-government research. Some theories are claimed to be imported from sociology, psychology, computer science and other fields into e-government studies. The importation of such theories has always posed a critique with a view that each discipline is meant to have theories inherent of that

particular field. This study renders support to scholars who have argued that such importation is crucial due to the intersection of academic disciplines and fields; it provides an important forum for creative theory building while harnessing such multiple disciplines (Zahra & Newey, 2009). Given the complex nature of society, native theories within a particular field may not be a true lens to understand it (Jain, 2004; Tan, Pan & Lim, 2005). However, this study is mindful that importation of theories has rendered information systems in general and e-government in particular a reference discipline.

Baskerville and Myers (2002) note that IS should not only be a referring discipline with many reference disciplines, but it should become one of many reference disciplines exchanging ideas in an intellectual discourse with other disciplines. In so doing, IS becomes a contributing discipline amongst others, warranting a generation of theories that can become native in the field. It has been emphasized that instead of "importing knowledge" from the so-called reference disciplines (the old unidirectional model), IS scholars should consider where there might be opportunities for collaboration with scholars in other fields. Notably, opportunities exist in areas such as medical informatics, electronic commerce and electronic government as information systems sub-divisions. This in turn will potentially facilitate intellectual progress in the IS field because of the ability to exploit the intersections between disciplines while at the same time focusing at the main goal of becoming a pure science.

However, for e-government in particular, most theories in e-government studies have been imported from other disciplines as they are or with some modifications. This importation of theories has been criticized by several authors who underscore that e-government interventions appear to be lacking a firm theoretical underpinning to inform its implementation (Titah & Barki, 2006). Some authors note that theory construction as undertaken by scientists should be a disciplined imagination, acting as a function of accuracy and detail present in the problem studied (Weick, 1989; Hartwick & Barki, 1994; Venable, 2006). Similarly, Friedman (2003) also emphasises that theory construction must be an ordered set of assertions about a generic behaviour or structure assumed to hold significantly throughout a range of specific instances. This implies that theories need offer a high-level preliminary focus to the problem domain where there is behaviour of people in that context involved during theory development. Most of the published e-government research employs popular theories in consumer behaviour, technology

adoption and technology diffusion, although a vast array of other theories are also used (Norris & Moon, 2005; Bélanger & Carter, 2012). Notably among consumer behaviour theories is the Cognitive Dissonance Theory.

Cognitive Dissonance Theory (CDT)

Cognitive Dissonance Theory (CDT) was introduced by Leon Festinger, who observes: “The individual strives towards consistency within him/herself. His/her opinions and attitudes tend to exist in clusters that are internally consistent. However, inconsistencies co-exist with consistencies” (Festinger, 1962: 195).

Festinger (1962) terms such inconsistencies that cannot be justified by oneself to the members of the social system as *psychological discomfort*, otherwise considered as *dissonance*. Consistencies, on the other hand, are considered as consonance. The author describes dissonance as the existence of non-fitting relations among cognitions, which is a motivating factor in its own right. Cognition is synonymous to knowledge, opinions, or beliefs about the environment, about self or about one’s behaviour (Ausubel, 2012).

CDT evaluates dissonance or psychological discomfort as a difference between cognition of something and its reality. In this study, this may be viewed as a deviation of the final e-government product or service from the original expectation. This points to a gap of some kind, or an outcome of discomfort or dissonance.

Consequently, an assumption is made in this study, which a potential approach to consonance or a sense of comfort amongst citizen users of G2C application services is through participatory design. Therefore, an important question that warrants investigation is whether participatory co-design reduces dissonance. A reduction of dissonance may occur when an e-government user interacts with others who would agree with and support or improve the user’s position by meeting their expectations in a collaborative manner. The meeting of such expectations to yield satisfaction of the user is well articulated in Expectation Disconfirmation Theory.

Expectation Disconfirmation Theory (EDT)

Expectation Disconfirmation Theory (EDT) (Oliver, 1980) is rooted in Cognitive Dissonance Theory (CDT). Expectation disconfirmation is two-way, consisting of formation of expectations

and disconfirmation of those expectations through performance comparisons. According to Expectancy Disconfirmation Theory, one reason for this difference in satisfaction levels of any service or application is the difference in expectation levels. Lin and Tsai (2005) highlight two key expectations:

- a) Ex-ante expectations: expectations of the product or service prior to purchasing or using it;
- b) Ex-post expectations: perceived performance influenced by the expectations.

Lin and Tsai (2005) argue that if the difference between actual performance and expectations is small, the perceived performance would increase (expectations are met) and vice versa. Perceived performance could therefore either confirm or refute the pre-expectations. In this study, Expectation Disconfirmation Theory has relevance because expectations of citizens need to be established at the onset of the e-government design process so that future adoption and usability may be deemed effective when such expectations are met. Other studies have conceptualized ex-ante and ex-post expectations in the form of predictive and normative expectations (Davis, 1985; Dyke, Prybutok & Kappelman, 1999; Waite, 2006).

Expectations may be inherent amongst both citizens and government involved in the e-government application design. Citizens may have their own predictive expectations based on their prior experience of related government interventions while at the same time government may have a normative expectation of what it thinks should happen for the citizens based on their mandate. Between the two aforementioned expectations, there is an ideal expectation of what the parties involved in the e-government application think would happen. This is where the reality-design gap is situated. The difference in these expectations could result in variations of the outcome of the e-government application in terms of its usability.

EDT involves four primary constructs: expectations, perceived performance, disconfirmation of beliefs and satisfaction. The outcome of satisfaction in respect to an e-government application may be of effective or ineffective use. Since expectation is a key construct in the theory, early collaborative design (or co-design) may be a precursor for an early judgment of the e-government artifact by the affected stakeholders. In a similar way, ICT adoption models based

on user expectations may explain satisfaction of usage of e-government applications as an outcome. Another relevant theory is the Theory of Planned Behaviour.

Theory of Planned Behaviour

The Theory of Planned Behaviour, advanced by Ajzen (1985), is an extension of the Theory of Reasoned Action, advanced by Fishbein and Ajzen (1975). These theoretical frameworks explain behaviour and its antecedents based on beliefs, attitudes and intentions. As such, they postulate the existence of mechanisms that underlie individual behavioural changes. A behavioural intention measure will explain the performance of any voluntary act since individual social behaviour is motivated by behavioural attitudes (Shih & Fang, 2004). According to the Theory of Planned Behaviour, human behaviour is guided by three kinds of considerations: beliefs about the likely outcomes of behaviour and the evaluation of these outcomes (behavioural beliefs); beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs); and beliefs about the presence of factors that may facilitate or impede performance of the behaviour and the perceived power of these factors (control beliefs) (Ajzen, 2002; 2006).

Aggregation of behavioural beliefs produce a favourable or unfavourable attitude toward the behaviour while normative beliefs result in perceived social pressure or subjective norm and control beliefs give rise to perceived behavioural control (Ajzen & Cote, 2008). In combination, attitude toward the behaviour, subjective norm, and perception of behavioural control lead to the formation of a behavioural intention (Ajzen & Fishbein, 1980; Ajzen, 1991; Bamberg, Ajzen & Schmidt, 2003).

Although these beliefs all influence the intention of individuals to behave in specific ways, the large majority of the existing literature in the IS field, such as studies on the technology acceptance model (TAM) have focused on investigating attitude and its antecedents (behavioural beliefs). This is because they assert that these beliefs can be reshaped by external interventions in the form of objective information concerning information technologies and their design (Bulgurcu, Cavusoglu & Benbasat, 2010).

From the foregoing, it is seemingly a general rule that the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger the person's intention to perform the behaviour in question. Given a sufficient degree of actual control over the behaviour, people are expected to carry out their intentions when the opportunity arises. This study further therefore argues that such intentions can be positive or negative depending on the extent to which social awareness is conducted (Dinev & Hart, 2005). Levels of awareness can stimulate acceptance or rejection of technology and a popular theoretical lens has been the Technology Acceptance Model.

Technology Acceptance Model (TAM)

TAM is a widely cited adoption and usage model in information systems studies advanced by Davis (Davis, 1985). According to the original model, a user's attitude towards using a given system is assumed a major determinant of whether or not they will use it. Attitude towards use is a cognitive issue, for which Davis highlights two constructs, viz. perceived usefulness and perceived ease of use. A cognitive response of a user results in an effective response (attitude towards using), which later predicts actual use (Davis, 1985, 1993).

Some studies use TAM in its original form while others have reproduced it with modifications. Developed to explain system use, the roots of TAM can be traced to researchers' effort to develop tools for measuring and analysing computer usage satisfaction and user motivation (Legris, Ingham & Collette, 2003). Consistent with Expectation Disconfirmation Theory and Consonance Dissonance Theory, satisfaction elements are related to one's feelings or factors affecting the situation (Legris *et al.*, 2003). Bailey and Pearson's critical incident interview technique (Bailey & Pearson, 1983) resulted in 39 factors that influenced user satisfaction. However, as this was a very long list of factors, the original authors and others worked to abbreviate them and make them more practical.

Legris, Ingham and Collette (2003) and Cheney, Mann and Amoroso (1986) grouped these factors into three categories of variables: uncontrollable (task technology and organizational time frame); partially controllable (psychological climate and systems development backlog); and fully controllable (end-user computing training, rank of end-user executive and end user computing policies). Davis (1989) proposed two major causes of acceptance or rejection of

information technology viz. perceived usefulness and perceived ease of use. However, inherent in ease of use and usefulness is the concept of perception that is behavioural and attitudinal in nature. This study proposes that this behavioural component, a key expectancy element in expectation disconfirmation theory, is pivotal during a co-design process during G2C application development. Other scholars have taken a different approach towards the extension of TAM. Based on the low predictive power of the TAM constructs for the outcome behaviour and the contradicting results from various studies, researchers have extended the TAM model (Venkatesh *et al.*, 2011).

Extension of Two Stage Information Systems Continuance Model

Following on TAM and EDT, this study further reflects on Venkatesh, Thong, Chan, Hu and Brown (2011) who advanced a two-stage model of TAM due to the contextual nature of IS studies. The model has two other pre-usage constructs viz. pre-usage beliefs and pre-usage attitudes as predictors of ICT usage. Within this model, the underlying constructs in TAM's original model that explain adoption of technology are attitude, perceived usefulness, perceived ease-of-use and intention to use. Still, these are cognitive constructs that may be overt or covert and can be well understood by the ICT designer if handled during a co-creation approach. This study postulates that there can always be interplay of various stakeholder mandates, aspirations, attitudes, beliefs, emotional reactions, expectations and other non-spoken information that may not be easily integrated into the design when a designer is aloof. The study therefore argues that a participatory design process could have the ability to disconfirm the negative beliefs, attitudes and their associated expectations while at the same time confirming such beliefs and expectations that are positive.

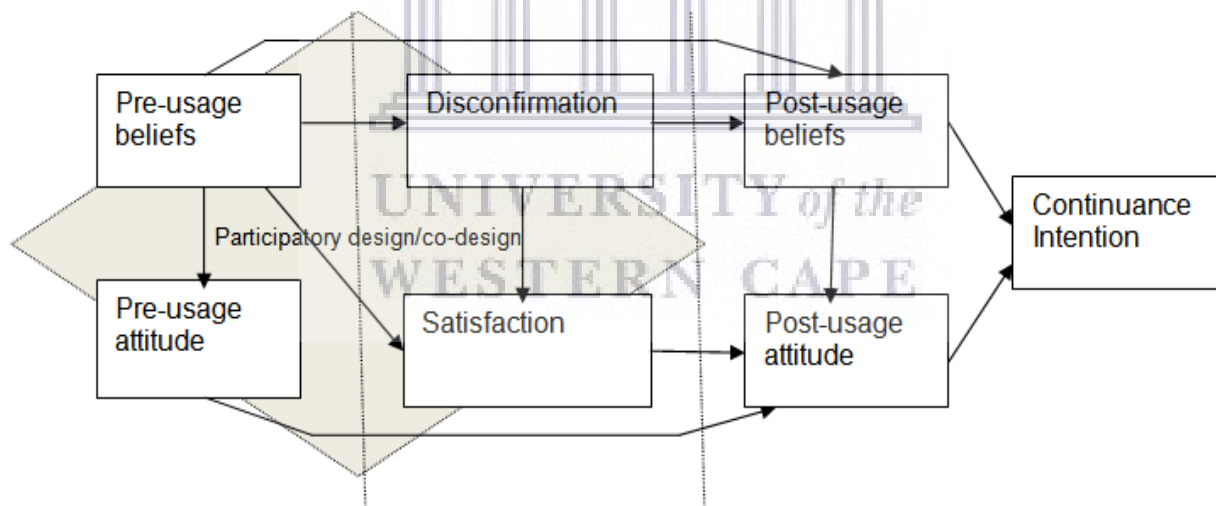
Implication and Limitations of the Above Theories

These theories have been applied in various studies to explain the phenomenon of technology adoption. They intend to explain particular instances of the phenomenon, most of which relate to mandatory use, rather than all possible usage occurrences including voluntary use which is a key usage characteristic of marginalised people (Kontos & Poland, 2009). Since most of the aforementioned theories are used as predictive theories, offering pointers to the perceived system usage and adoption, in this study, such theoretical constructs are considered *a priori*. They were

used to offer a theoretical framework for naming the emerging constructs during the participatory design research process. Some offered a lens for evaluating the artifacts developed during the co-creation process.

Boundaries of Participatory Design

The above theories provide predominant constructs that determine performance of behavioural outcomes. Such behavioural outcomes are from cognitive constructs like knowledge, abilities, practices, attitudes and skills. Most outstanding can be the pre-usage beliefs and pre-usage attitudes that influence post-usage beliefs and post-usage attitudes. This study postulates that disconfirmation of the negative pre-usage beliefs and pre-usage attitudes or confirmation of the same pre-usage cognitive expectations can best happen when the participatory design process is introduced early enough in the inception of application development (e-government application development). Figure 9 below offers a hypothetical positioning of the participatory design initiative.



Juxtaposition of participatory design initiative model

(Source: Adopted and modified from Venkatesh *et al.*, 2011)

This study is premised on an assumption that participatory design has the potential to uncover citizens' e-government pre-usage beliefs and pre-usage attitudes. This occurs at the problem co-discovery and co-definition stages, while at the same time disconfirming beliefs, where it is necessary, and thereby yielding some degree of satisfaction during the participatory design

process. This study further posits that the outcome can be post-usage beliefs and post-usage attitudes (usability) that may ultimately result in a continued intention to use an e-government application. However, based on a marginalised community's context, pre-usage beliefs and attitudes could be influenced by citizens' capabilities based on empowerment of such individuals. A capability approach can be a viable model to examine marginalised citizens' attitudes and beliefs in respect of their prospective e-government usage.

Capability Approach

Applying Sen's capability approach (2005) to information systems design for various context leads to the view that it is not merely access that is crucial, but the distribution of social resources that convert access into use. The core premise of the capability approach is an understanding of what individuals are able to do or are capable of.

Drawing on Sen (2005), there are five components relevant to assessing capability:

- a) Individual differences in the ability to transform resources into valuable activities;
- b) The importance of real freedoms in the assessment of a person's advantage;
- c) The multivariate nature of activities giving rise to happiness;
- d) A balance of materialistic and non-materialistic factors in evaluating human welfare; and
- e) Concern for the distribution of opportunities within society.

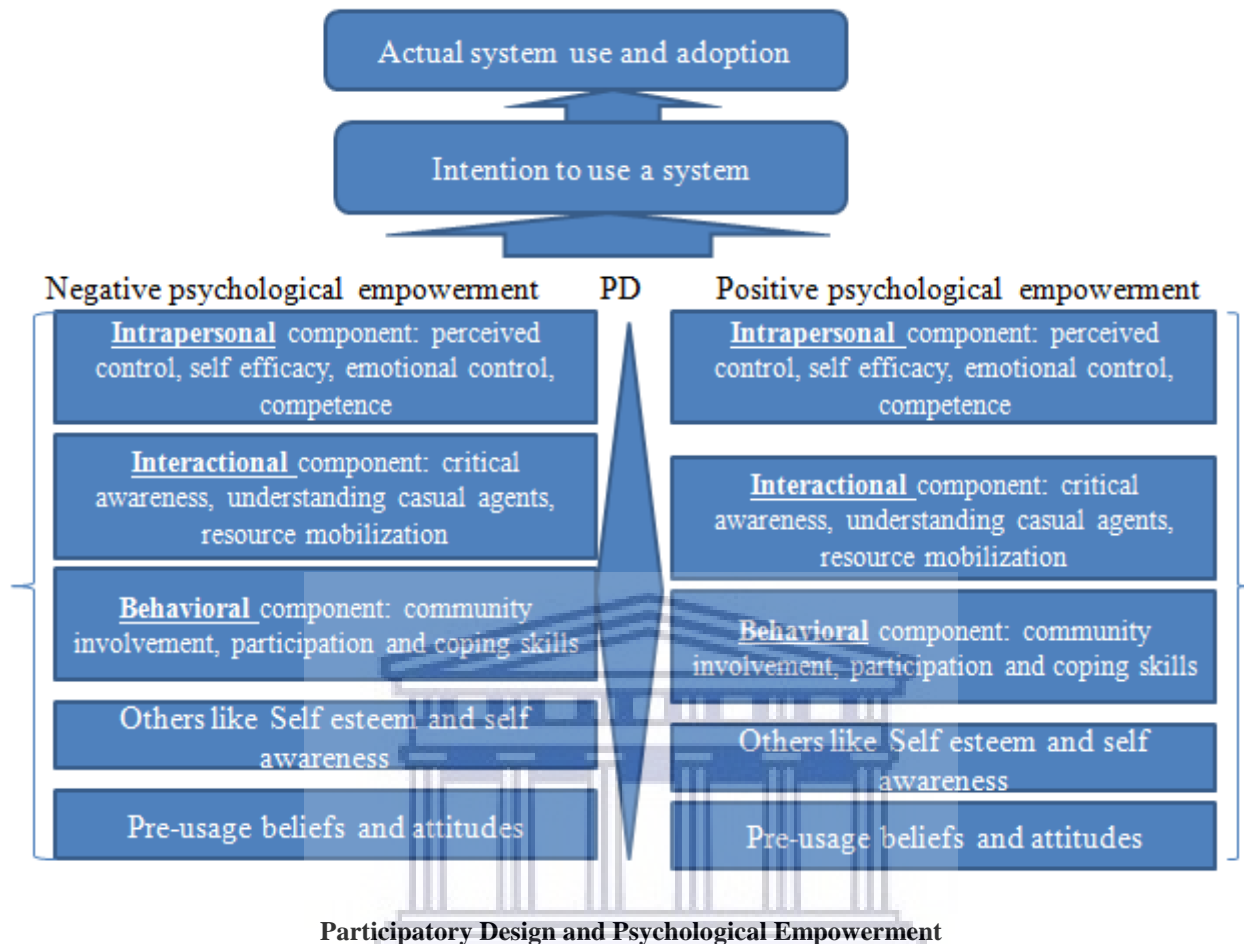
This study asserts that such an assessment of capabilities needs to be in a collaborative manner that can be attained through participatory design of ICT applications in marginalised community settings. Several studies have used this approach and reveal interesting results that inform this study. For instance, Kleine (2011) warns that development interventionists and funders need to accept the fact that people's choices are never fully predictable and thus Sen's "development as freedom" will inevitably be a dynamic and open-ended process. This study posits that, in our efforts to improve the livelihood and well-being of citizens, we need to target intentions to perform a behaviour. This is because behaviour intention is a value of three determinants viz. the person's attitude toward performing the behaviour; the person's perception of the social (or normative) pressure exerted on him or her to perform the behaviour; and the person's belief in his or her ability to perform the behaviour (self-efficacy) (Yen-Tsang, Csillag & Siegler, 2012). This

results in empowerment of the person to perform the behaviour (Kieffer, 1984; Zimmerman & Rappaport, 1988; Florin & Wandersman, 1990; Hur, 2006; Gomez & Pather, 2012).

Kleine (2010) clearly articulates the context of marginalised communities as being in a state of vulnerability, requiring pro-poor policies to stimulate empowerment and other mechanisms under play in order to yield better livelihood outcomes. Numerous other scholars have linked the capability approach to better empowerment outcomes (Farrington *et al.*, 1999; Gigler, 2004; Robeyns, 2006; Kleine, 2010; Oosterlaken, 2012). From such studies, there is clear connection of the capability approach to the theoretical construct of empowerment.

Psychological Empowerment Theory

It is evident that the inherent constructs in investigating a participatory design approach are related to psychological issues and empowerment. One of the most cited theoretical frameworks for empowerment is Psychological Empowerment Theory (Zimmerman, 1995). Despite the extant literature providing a number of recommendations for improving usability of e-systems, such recommendations are related to awareness creation and training and no specific strategies are documented to empower the marginalised. We therefore suggest that participatory design has the ability to contribute to a process by which marginalised citizens and communities can gain mastery, and hence empowerment, over issues of concern to them in respect to e-government usability. Figure 10 presents a “double sword” where participatory design can be used to overcome the negative beliefs, attitudes and behaviour while at the same time yielding positive empowerment.



(Source: Developed and modified from Zimmerman, 1995)

Zimmerman (1995) proposed psychological empowerment components as measurable constructs of concern because:

- a) It manifests itself in different perceptions, skills and behaviours across people and communities;
- b) Different beliefs, competencies and actions may be required to master various settings; and
- c) It fluctuates over time.

Psychological empowerment has been revealed as an open-ended construct and therefore the specified components must be used as observable measures during the participatory design process. Hussain, Sanders and Steinert (2012) used them to examine participatory design to develop ideas and subsequent devices for children to use prosthetic legs in Cambodia. Their results revealed that marginalised people were empowered (i.e. the resultant artifact met both

their needs and enabled their psychological empowerment). Ozer and Douglas (2013) and Ozer and Schotland (2011) used participatory youth initiatives and found out that it fosters positive development, motivating outcomes and enhances civic participation among economically disadvantaged urban youth. Through participatory design and working, psychological empowerment leads to psychological capabilities and functioning (Ozer & Schotland, 2011).

In this study, psychological empowerment and its associated constructs are pertinent for assessing the mechanisms operating among the e-government stakeholders. We postulate that psychological empowerment aids effective participatory design to take place. Furthermore, as an output construct, participatory design constructs can lead to psychological empowerment and an improvement in the design outcome. However, as this is not a theory verification study, such constructs could be dropped if they offer no evidence and alignment to the data collected during the empirical phase of the research.

Conclusion

Despite a number of theories devised to predict e-government adoption behaviour, research suggests that collaborative initiatives are inhibited by behavioural constraints. While most studies tend to advance technical reasons hindering IS and e-government adoption in particular, this study draws from a socio-technical approach to suggest that the interaction among social, technical and contextual features can give rise to behaviour that constrains design of people-centric systems. Effective information systems design can be constrained by behavioural aspects, which limit the realisation of design outcomes and goals. This implies that there is need for *a priori* consideration for the social and contextual implications of the technical designs. A number of behavioural theories have been reviewed as a way of predicting user acceptance and generating theoretical constructs for naming identified behaviours during participatory design process, but there is need for a thorough conceptualization of theories related to design if effective participatory design is to be realized.



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