

**MECHANISMS FOR EMERGENT USAGE OF ADAPTIVE
INFORMATION SYSTEMS: A CRITICAL REALIST CASE
OF e-FINANCIAL SYSTEMS IN SOUTH AFRICA**



BY

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Declaration

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Dedication

To, my amazing daughters
Chiamera and Olive, beautiful ornaments in the king's palace
and reassuring sons Samuel and David, with hope,
my infinitely supportive and virtuous wife, Ada, with love,
and my ever-encouraging and optimistic parents, with gratitude.

List of Abbreviations and Acronyms

ANT	Actor-network theory
APIs	Application Programmable Interfaces
ATM	Automatic Teller Machines
AST	Adaptive Structuration Theory
BBEE	Broad-Based Economic Empowerment
CAS	Complex Adaptive Systems
CMUA	Coping Model of Usage Adaptation
CUE	Components of User Experience
DFIs	Development Finance Institutions
DREI	D=describe the events of interest; R=retroducte explanatory mechanisms; E=eliminate false hypotheses; I=identify the correct mechanisms
DSDM	Dynamic Systems Development Method
e-commerce	Electronic Commerce
e-financial	Electronic Financial
e-product	Electronic Product
eReadiness	Electronic Readiness
ECM	Expectation-Confirmation Model
ECT	Electronic Communication Transaction
EUD	End-user Development
ERP	Enterprise Resource Planning
EUC	End-user Computing
EUP	End-user Programming
EUSE	End-user Software Engineering
ESB	Enterprise Service Bus
FAM	Fit Appropriation Model
FDD	Feature Driven Development
FNB	First National Bank
GDP	Gross Domestic Product
GPS	Global Positioning System
HCI	Human-computer Interaction
ICT	Information and Communication Technology
JSE	Johannesburg Stock Exchange
IS	Information Systems
ISO	International Organization for Standardization
ISURA	IS Use-related Activity
IT	Information Technology
LTS	Long-term Savings

MAR	Mobile-Augmented Reality
MARS	Multivariate Adaptive Regression Splines
MTA	Model of Technology Appropriation
NCA	Nation Credit Act
NFC	Near-field Communication
ORISs	Operational Risk-aware Information Systems
PFM	Personal Finance and Management
PIIT	Personal Innovativeness in IT
PIN	Personal Identification Number
POS	Point-of-sale
POPI	Protection of Personal Information
QDAS	Qualitative Data Analysis Software
REST	Representational State Transfer
RSS	Rich Site Summary
SARB	South Africa Reserve Bank
SER	Seeding, Evolutionary Growth, and Reseeding
SMEs	Small- and Medium-sized Enterprises
SOA	Service-Orientated Architecture
SPI	Software Process Improvement
SRA	Strategic Relational Approach
STSs	Socio-technical Systems
STWT	Socio-technical Walkthrough
SSW	Software Shaping Workshop
TAM	Technology Acceptance Model
TEUM	Technology Emergent Usage Model
TMSA	Transformational Model of Social Activity
TTF	Task-Technology Fit
UX	User/Usage Experience
WOA	Web-oriented Architecture
XP	eXtreme programming

MECHANISMS FOR EMERGENT USAGE OF ADAPTIVE INFORMATION SYSTEMS: A CRITICAL REALIST CASE OF e-FINANCIAL SYSTEMS IN SOUTH AFRICA

Abstract

The purpose of this research is to investigate the research problem: *Why does emergent usage occur in adaptive information systems?* Being motivated to explore this phenomenon from the experiential perspective, three research questions were posed: (1) *What experiential factors describe emergent usage of adaptive information systems?* (2) *What generative mechanisms must exist for such emergent usage to be possible?* (3) *What explains the relations of the mechanisms to effect emergent usage of such information systems?* Emergent usage of adaptive information systems, predominantly accessed with smart mobile devices has become pervasive. The research problem, therefore, arises as a result of the continued under-theorization of emergent usage of adaptive information systems and lack of theory to explain why such usage occurs. To answer the research questions, an intensive single organization case-study, underpinned by critical realism, was deployed. The research explored an adaptive e-financial system developed by the case organization for public use. The research was aimed at identifying the causal mechanisms and the enabling contextual conditions that explain the system's emergent usage and the experiential factors that describe such usage. Multiple sources of qualitative data, namely, participant observation, interviews, and photography were used to collect data between 2012 and 2014. The retroductive data analysis employed a research model which was developed from a theoretical redescription of the phenomenon using a conceptual framework synthesized from literature and theories of complex adaptive systems (CAS) and meta-design. The findings were encapsulated in a concluding model termed, the Technology Emergent Usage Model (TEUM), as the key theoretical contribution of this thesis. TEUM is an explanatory case specific mid-range theory. The theory's relevance is based on its openness to flexible interpretation when applied to different contexts in future research, without making claim to its universality. Other contributions include methodological and practical contributions to highlight an area where there has been little or no empirical research to date.

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Chapter 1

Emergent IS Usage Problem: Reasons for Research, Context, and Approach

“It is true that [emergent usage] occurs in a behavior-based system is often a surprise to the system’s designer but does the surprise come because . . . of [what]. . .?”

(Arkin 1998, p. 105)

1.1 Introduction

This chapter lays the research foundations by providing an overview of the research problem, the research questions, and the approach taken to address the problem. It also discusses the motivation and background for the research and the thesis structure.

1.2 Research Problem and Questions

An emerging class of information systems (IS) known as adaptive IS exists. Adaptive IS are systems that changes in the face of perturbations (i.e., user requirement changes in task accomplishments) so as to maintain some kind of invariant state by altering its behaviors or modifying its environment (Arkin 1998). They are highly interactive systems suited to support user engagement and service consumption experience. Their effective functioning mainly depends on user-system interactions that involve tweaking, modification, appropriation, and embodiment of the system while-in-use in an aesthetically-enriched environment. While such kind of usage occurs, the system evolves with new structures to support user requirement changes (Fischer and Herrmann 2011). Such usage is classified as emergent and is defined as a post-adoptive behavior in which users modify IS in their context-of-use based on

their direct engagement and experience, to meet personal relevance in ways that were not planned by designers. The IS use epitomizes the capacity of users to alter the software artifact and its meanings through diverse practices, interactions, and dynamic interpretations in the form of adaptation (a change in the meaning of the artifact and the ways in which it is used) and/or reinvention (a transformation of the meaning, the use, and the structure of the artifact) (Siles and Boczkowski 2012; Straub and del Giudice 2012).

Pervasiveness of emergent IS use is not in doubt, but what would be interesting to know is *why does it occur in adaptive IS?* This question lingers in IS research (Markus and Robey 1988; Straub and del Giudice 2012), generates concerns among IS scholars and practitioners (Benbasat and Barki 2007; Hovorka and Germonprez 2013; Straub and del Giudice 2012), as well as captures the research problem of this thesis.

Straub and del Giudice (2012) lament that “*some scholars have tried to reformulate use in this way [i.e., transformative use as they choose to call it] . . . and this has been a fruitful (but sadly stillborn) development*” (p. iii-iv). Some IS scholars (e.g., Burton-Jones and Gallivan 2007) are of the view that theorizing IS use at the ‘deep structure’ level is rewarding as it allows us to explain how a user restructures information, recombining IS features that evoke interesting new ways of using IS. Benbasat and Barki (2007) also argue that researchers should build richer models that could explain a broad range of usage behaviors such as user adaptation, learning, and reinvention. Despite its importance in the understanding of user-system interactions, few studies have attempted to explain the reasons behind the occurrence of emergent IS usage.

To address this problem, a critical realist approach is adopted to unveil the underlying mechanisms that could cause emergent IS usage to exist, or mechanisms that encourage users to enrich their use of implemented IS in novel ways. Critical realism is adopted because the research investigation aims to identify deep causal structures rather than the surface events of what we observe to be true (Mingers et al. 2013). An adaptive e-financial system is the investigative context of this thesis. Such systems are developed and deployed for public use by organizations in South Africa.

Individual users, who must be customers of banks, appropriate or adapt their financial service offerings to achieve personal relevance in their situated contexts-of-use. Specifically, such a class of IS realizes its true potential only through its emergent usage by active end-user communities in South Africa's e-financial ecosystem. Thus, the purpose of this research is to identify the generative mechanisms that may cause the system's emergent usage and the experiential factors that describe such usage. In doing so, the study answers three research questions, as detailed next.

Firstly, the study is motivated by the call for research to look at IS from an experiential perspective that explicates the usage events (Wynn and Williams 2012; Yoo 2010). The IT-mediated perception of an e-financial environment lends itself to focusing on an experiential aspect. From this perspective, user-system interactions are associated with embedded structures which directly mediate users' everyday life banking or financial activities. Because access to the system is constantly re-negotiated based on emergent user/usage experience (UX) (Knijnenburg et al. 2012; Oja and Galliers 2011; Yoo 2010), the research aim is to identify the experiential factors that describe such UX. Actual usage cannot be realized without consumption experiences of the services the technology renders and is accessed via the smart mobile devices. Therefore, emergent usage of the IS is considered as a behavior that is akin to a complex interplay of interactions and experiences that cannot be divorced from each other in a situated context (Heeks 2002; Oja and Galliers 2011). Thus, the first research question is:

Research Question 1 (RQ1): *What experiential factors describe emergent usage of adaptive information systems?*

Secondly, the experiential perspective helps in retroducting backward to exhume the underlying mechanisms that may cause the system's emergent usage experience to occur. Recognition of such experiential factors that describe the phenomenon under study is a means to unveil the underlying causal mechanisms. As Bhaskar (2008b) would say: "*When a stratum of reality has been adequately described the next step consists in the discovery of the mechanisms responsible for behavior at that level*" (p. 160). To do this, extant theories of complex adaptive systems (CAS) and meta-

design are used as lenses for such a retroductive move in the system's environment. Both theories conceptualize emergence as a process that accounts for qualitative novelty (Fischer and Herrmann 2011; Nan 2011). They empower the researcher to look at the system's emergent usage as an innovative or reinvention process with unpredictable outcomes. Emergent interactions among autonomous agents (i.e., individual, organization, environment, software artifact) and their self-reinforcing mechanisms are accounted for by both theories (Fischer and Herrmann 2011; Markus and Robey 2004; Nan 2011). The theories also empower the researcher to consider emergent IS usage as a set of dynamic and adaptive interactions. Consequently, such usage can be theorized at the individual level, without ignoring the organizational and environmental impacts associated with the technology's situatedness.

Users outside the organization context could reflect upon their usage experiences as feedback, implicitly restructure the system by reason of such reflections, and appropriate the IS structures in their contexts-of-use, to achieve personal relevance. By observing this behavior, one can identify and explain the mechanism-based interactions of the system in practice, its conditioning power to shape people's behavior, and its evolutionary effects that are helpful for designers' updates of the software within the organizational context. Thus, the following question is asked:

Research Question 2 (RQ2): *What generative mechanisms must exist for such emergent usage to be possible?*

Thirdly, although IS scholars have generally acknowledged the pervasiveness of emergent usage behavior in adaptive IS (Fuller and Dennis 2009; Sun 2012), there are limited theories to render a mechanism-based causal explanation of such usage (Avgerou 2013; Markus 2014). Besides, there are no theories to the best of my knowledge that could help in understanding the interactive relations of the mechanisms and their effects in generating such usage outcomes. Thus, the last research question is proposed as:

Research Question 3 (RQ3): *What explains the relations of the mechanisms to effect emergent usage of such information systems?*

The research questions infer that the goal of this thesis is explanation. Explanation is a goal for certain types of theoretical studies (Gregor 2006; Markus 2014), but is rarely discussed in depth in IS literature (Hovorka et al. 2008), especially when it takes the form of mechanism-based explanation involving a causal detail of why an IS phenomenon has happened (Avgerou 2013; Gregor and Hovorka 2011; Markus 2014; Nan 2011). Therefore, a mechanism-based explanation of the emergent use of adaptive IS at the individual level will be developed, especially when deployed for e-financial service-systems in South Africa.

1.3 Research Approach

To explore or rather answer the research questions, the research focuses on using an abductive-retroductive strategy (Mingers et al. 2013). Such a strategy empowers the researcher to use systemic thoughts (Mingers 2011) as lenses, and move backwards beyond the observable experiences users encounter in the technology's actual usage, in order to understand the underlying mechanisms (Easton 2010a; Mingers 2004c). The abductive-retroductive strategy is anchored by the critical realist assumptions, wherein Mingers (2004c, p. 95) emphasizes that to exhume the mechanisms one has to move *"from experiences in the empirical domain to possible structures and mechanisms in the real domain"*. The Danermark et al. (2002) explanatory framework is used in this study to specify the methodological principles for adopting critical realism and integrating it with intensive case-study research.

1.4 Background and Motivation

Over the past three decades, much valuable research has been undertaken to understand IS use at both the organizational and individual levels using two dominant conceptualizations – the technological deterministic view and the Giddens' (1994) structurationist view (Nan 2011; Orlikowski 1996). This significant body of work has advanced our understanding of IS adoption. Yet there exists another view, i.e., the emergent view of IS use, with the underlying assumption that IS use emerges *"through self-orchestrated interactions among users, technologies, and institutional properties rather than dictated by . . . [designers'] intentions"* (Markus and Robey 1988; Nan 2011, p. 505). Due to the dominance of the deterministic and structurationist views of IS use (Jones and Karsten 2008; Nan 2011), there is a

paucity of research on the emergent perspective (Hovorka and Germonprez 2013; Straub and del Giudice 2012). The notion of emergent usage of technology in the IS field is not a new concept per se, having been advocated by Markus and Robey (1988). However, what is new is that such an emergent perspective has not focused on causal structures/mechanisms or addressed the need of users outside the typical organizational context or societal level (Avgerou 2013; Jones and Karsten 2008; Nan 2011; Yoo 2010). A recent study conducted by Pare et al. (2008) that analyzed 'IT usage impact' noted that only 0.6% of the set of papers examined adopted a societal level of analysis, with a technological deterministic view still dominant in over 60% of the studies sampled. Besides, most studies that adopt a technological deterministic view regard technology *"as an exogenous force that determines the behavior of individuals and organizations"* (Markus and Robey 1988, p. 585). The technological determinism works on the assumption that correlation is the same as causality (Gregor and Hovorka 2011). When such causalities occur in technology use it is unidirectional with implications *"that beliefs and attitudes come before behavior, despite evidence that behavior also shapes attitudes and beliefs"* (Fidock and Carroll 2012, p. 86). People could act by past experiences, apperceptions, and improvisations, not by intentions (Heeks 2002; Mintzberg and Westley 2001; Saariluoma 2003), and may not necessarily act consciously, but by habit (Limayem et al. 2007); sometimes these habits are embedded in IT artifacts (Polites and Karahanna 2013). *"While providing insight into the often determining aspects of technology, technological [determinism] largely ignores the action of humans in developing, appropriating, and changing technology"* in an evolving context (Orlikowski 1992, p. 400).

Similarly, structurationists, while focusing on the time-dependent act of technology in mutually transforming the interactions among IS features, human actions, and institutional properties, still place their studies at the organizational level for the most part (Jones and Karsten 2008; Orlikowski 1992). Jones and Karsten (2008) highlight the limitations of structurationist specificity in organizational settings, while advocating a broader societal context to address the relationship between IS and people. When the structurationists' view (Giddens 1984) is driven towards emergent IS use, they ignore the causal power of technology (Orlikowski 1996), thereby deviating from Markus and Robey's (1988) emergent perspective.

In Orlikowski's (1996) words, emergent IS use comes by "*the ongoing, gradual, and reciprocal adjustments, accommodations, and improvisations enacted by the [actors/users of the technology]*" (p. 69). By ignoring the materiality of technology, the structurationists' perspective ends up privileging social actions within the IS adoption discourse, especially when particularized to workplace systems. Materiality of technology as used here is defined as the artifactual structures of IS and its non-deterministic causal efficacy that enables and constrains actions (Leonardi 2012). Several IS scholars frown upon the under-specifying of artifactual structures of IS and its functional affordances within the structurationists' perspective (e.g., Lee 2004; Leonardi 2011; Markus and Silver 2008; Mutch 2013; Tiwana et al. 2010; Volkoff et al. 2007). The structurational view of emergent IS use also ignores "*the linkage of individual micro-level action and the macro-level institutional processes*" that are useful for IS usage to emerge in response to the contextual conditions where the system is designed and situated (Carlsson 2005; Cuellar 2010; Dourish 2003; Jones and Karsten 2008, p. 150).

In an attempt to address these issues, Orlikowski (2010) proposes the lens of sociomateriality as a valuable alternative. However, her notion of constituted entanglement of the social with the material as 'one figure in deep relation' inherits similar limitations of structuration theory (Leonardi 2013a; Mutch 2013). The influence of structuration theory on this perspective of sociomateriality is still apparent (Leonardi 2013a). Here, the social (agency) and material structures of IS are entwined in a deep and inseparable conflation by a process of constitutive entanglement (Orlikowski and Scott 2008b). Thus, Orlikowski's (2010) view of sociomateriality does not address the ontological separation of the materiality of IS and its social subsystem in its transformational interactions (Faulkner et al. 2010; Leonardi 2013a). Besides, by not taking into account temporality, evident in the conflation of structure and praxis, Orlikowski's (2010) view of sociomateriality tends to overlook how the artifactual structures users confront at a certain time (t+1) condition their further actions at some other time (t+2) (Mingers 2004a).

In summary, the emergent view proposed by structurationists as guided by the Giddens structuration theory or the sociomateriality lens of Orlikowski's (2010) has "*no distinct and separate social or technological elements that might shape, or be*

shaped by, each other” (Orlikowski 2010, p. 135). With this view, *“the concept of causality is extremely problematic”* (Gregor 2006, p. 617). When applied to the emergent perspective it denies the pre-existing structures of IS and the materially embodied causal efficacy of technology (Mutch 2013). Emergence only exists in the domain of the actual (i.e., ontological actualism), where IS structures are reduced to their performance in practice. While acknowledging the irreducible novelty in IS use (Orlikowski 1996), such views reject the transcendental cause of IS use. IS researchers (e.g., Mutch 2010b; Volkoff et al. 2007) have turned to the critical realist theory of morphogenesis to (re)address some of these problems, but these studies are often focused on the influence of IS structures on organizational systems and their effects on organizational change. Nan (2011, p. 514) maintains that “. . . *previous studies have amply discussed the relationship between structures and IT use behaviors; a precise account of the mechanisms underlying these relationships has not yet emerged*”.

Thus, this thesis takes the path of critical realism-based research in an attempt to respond to the call of several IS scholars that we have seen so far. For several IS scholars (e.g., Lee 2004; 2010; Nan 2011; Straub and del Giudice 2012) research should be more about building rigorous and system-oriented explanatory frameworks in socio-technical settings to identify the mechanisms responsible for emergent IS usage. Other scholars (e.g., Avgerou 2013; Markus 2014; Volkoff and Strong 2013) believe that such mechanism-based models should be case-specific to increase their usefulness. The outcome of the research will highlight the emergent perspective of IS usage specific to new socio-technical phenomena such as e-financial systems and their causal mechanisms. Researchers can then account for the transformational interactions of the technical, micro-social (individual), and macro-social (organizational and environmental) objects which play a causal role in such IS usage, but which have been unaccounted for in previous theories (Jones and Karsten 2008; Nan 2011).

1.5 Thesis Structure

The structure of the thesis as shown in Figure 1 consists of four developmental phases represented across the ten chapters of the thesis.

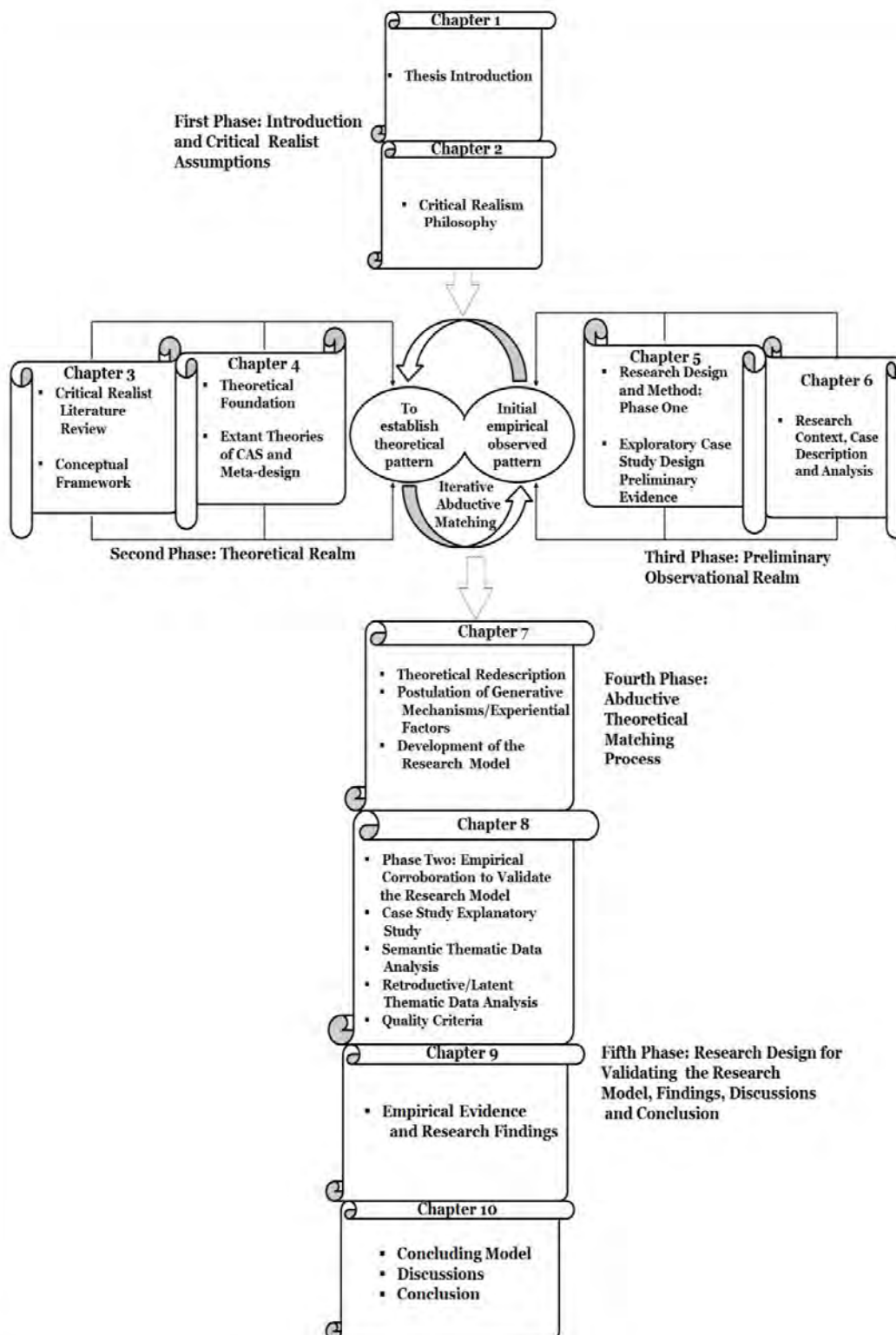


Figure 1: Map of the Thesis Structure

The **first phase** consists of two chapters. **Chapter 1** introduces the research problem, research questions, approach, background and motivation. **Chapter 2** provides useful insight into critical realism to guide the entire research project.

The **second phase** introduces the *theoretical realm* of the thesis and contains two chapters, i.e., Chapters 3 and 4. **Chapter 3** contains the critical realist literature review that culminates in the development of a conceptual framework. **Chapter 4** discusses the definitions, nature, and forms of theory. It also discusses how the definition of a theory should be framed from a critical realist perspective; it introduces the extant theories of CAS and meta-design, and presents an immanent critique (i.e., critique of theories using their own standpoint) of other rival theories.

The **third phase** of the thesis presents the *preliminary observational realm* underpinning the study. It consists of Chapters 5 and 6. **Chapter 5** outlines the entire case-study research design and the exploratory case-study, being the preliminary phase for data collection and analysis used in exploring the phenomenon. **Chapter 6** focuses on the case description and specific context of the research as the findings of the preliminary case-study field work discussed in Chapter 5. The Phase 1 research design in Chapter 5 offers the initial empirical evidence and is used to enrich the Chapter 6 explication of the events under study.

The **fourth phase** of the thesis presents the abductive theoretical pattern-matching process as outlined in **Chapter 7**. It involves matching the *theoretical realm* and the *preliminary observational realm* in an iterative fashion and this is expressed in the form of theoretical redescription. The theoretical redescription also showcases the congruence between the conceptual framework and the theories of CAS and meta-design in the light of the initial empirical evidence, as a form of particularizing these theories into the investigative context of the research. The abductive pattern-matching culminates in the development of the research model as the product of the theoretical redescription.

The **fifth phase** consists of three chapters, namely Chapters 8, 9, and 10. They describe another methodological design underpinning the thesis, research findings, discussion, and the conclusion. **Chapter 8** outlines the Phase 2 of the research

design. It consists of explanatory case-study as the method used in rendering the empirical corroboration needed to validate the research model. It also describes the explanatory case-study data collection activities and the thematic data analysis procedures. **Chapter 9** examines the research findings in the light of the research model, with support from prior literature. **Chapter 10** presents the concluding model of the thesis, the discussion about the findings with theoretical support from prior studies, and concludes the thesis. It also provides a summary overview of all the chapters. It identifies key contributions of the study, as well as its limitations and ideas for future research.

Chapter 2

Critical Realism Philosophy

“[a]n ontology without a methodology is deaf and dumb; a methodology without an ontology is blind.”

(Archer 1995, p. 28)

2.1 Introduction

This chapter discusses the critical realist paradigm as it *“specifies the ontological, epistemological and methodological presuppositions at work in . . .”* this research (Bhaskar and Danermark 2006, p. 282). All research methodologies rest on ontological and epistemological commitments. The ontological assumptions unveil the essence of the object under study or *why* the object exists. Epistemological assumptions provide a guide as to *what* can be known about the object that is believed to exist, which could be socially constructed (Peters et al. 2013). Once the *why* and the *what* questions that are associated with the ontological and epistemological commitments are answered, methodology offers us particular strategies to better know the object we think exists. Thus, ontology grounds epistemology, while epistemology in turn grounds methodology. Methods are the techniques followed to conduct research, e.g., collecting and analyzing data, and are influenced by the methodology (Mingers 2001).

In this chapter, the research will not dwell on the ontological question of ‘being’. Rather it considers ontology as *“the claims or assumptions that a particular approach to social inquiry makes about the nature of social reality”* or its philosophical underpinning (Blaikie 1993, p. 6). Because of its powerful influence, it is recommended in research that the philosophical underpinning of a study be made

explicit so that readers are able to “*critique a specific research . . . [strategy] for the extent to which it is true to the ontological and epistemological commitments to which it adheres*” (Saleh 2009, p. 145; Walsham 1995). Thus, this chapter explicates the critical realist assumptions that underpin this research. To advance the course of this discussion, the next section will begin with what a research paradigm is taken to be in IS research.

2.2 Research Paradigms in IS Research

Any scientific knowledge generated in IS as with every other scientific discipline is informed by research paradigms. The term paradigm is used in a multiplicity of confusing ways in the IS discipline (Mingers 2001, 2004b). In this study the research holds the view that paradigm inherently consists of epistemological stance (i.e., ontology, epistemology, and methodology) that collectively frame the nature of the research inquiry (Becker and Niehaves 2007). This view is also augmented with paradigm as a worldview, known as a basic set of assumptions that guide a scientific inquirer, based on internalized perceptions, experiences, and viewpoints (Becker and Niehaves 2007; Morgan 2007). A researcher’s worldview determines the meta-theoretical assumptions about the world, which in turn are intrinsically connected to the underlying methodological approach of the research (Knight and Cross 2012). Trauth (2001) classifies the paradigmatic worldview of researchers as their ‘theoretical lens’ and ‘skills’ that reflect their ‘self-driven cognitive entity’; used to influence a research project. It is also an inevitable mind-set, knowledge, ethics, and biases that researchers bring into the research process to constitute the intrinsic part of the research (Janesick 2000). A researcher’s worldview can be value-free and unbiased in the research process (Orlikowski and Baroudi 1991), and this is commonly found within positivistic research practices. However, Weber (2004) argues that nobody really takes such a stance anymore, giving room for value-laden positivistic research. A researcher’s worldview can be value-laden with epistemological recognition of bias and the ‘self’ as fundamental to the research process (Walsham and Sahay 1999) and this is common with interpretivist research practices. Other researchers’ worldview is value-aware with a recognition of the fallibility of knowledge; critical realist research practices subscribe to this type of worldview (Easton 2010a).

Most times the worldview of a researcher can be influenced by: (1) paradigm as shared beliefs and (2) paradigm as model examples of research (Morgan 2007). Paradigm as a shared belief is a set of assumptions and practices shared within a community of researchers about a way of viewing reality or appropriate procedures for addressing a research question (Morgan 2007). Paradigm as a model example of research is that version of paradigms that treats a given piece of research as an exemplar of how research is done in a particular field (Morgan 2007). It provides ‘paradigmatic examples’ of how the IS discipline addresses its central issues. Kuhn (1970, 1974) considered paradigm as model examples of research as important and it is explicitly considered in most IS research. Research projects are themselves considered as ‘case studies’ that serve as paradigmatic examples. IS researchers have offered models and paradigmatic examples to carry out a positivistic case-study research design (e.g., Benbasat et al. 1987; Eisenhardt 1989). In like manner, principles and examples for conducting interpretivist (e.g., Klein and Myers 1999) or critical realist (e.g., Wynn and Williams 2012; Williams and Karahanna 2013) research have been proffered. Such exemplars, especially the critical realist IS research, are used to provide the necessary backing for adopting a critical realist case-study approach in this thesis.

2.3 Paradigm as an Epistemological Stance

Paradigm as an epistemological stance consist of the meta-theoretical assumptions, associated with positivism, interpretivism, critical realism, critical theory, and pragmatism philosophies underpinning IS research (Goldkuhl 2012; Orlikowski and Baroudi 1991). Paradigm as an epistemological stance is discussed in the writings of Kuhn (1970, 1996) and is also the most widely discussed version of paradigm in the IS research domain (Mingers 2004b). It is often implicitly discussed in IS research and subsumed in the paradigmatic worldview of the researchers (Khazanchi and Munkvold 2003).

Hirschheim and Klein (1989) specify a set of meta-theoretical assumptions to distinguish paradigms as epistemological stance in IS research by drawing from Burrell and Morgan’s (1979) meta-theoretical schema. This set of meta-theoretical assumptions consists of: (1) functionalism that resonates with positivist ideology,

and (2) social relativism that is akin to interpretivism, neo-humanism (radical humanist/critical theorist), and radical structuralism (Hirschheim and Klein 1989). Other IS researchers (e.g., Fitzgerald and Howcroft 1998; Weber 2004) have followed suit in attempting to classify paradigmatic assumptions in IS research. Weber (2004) provides an axiomatic classification of positivist (naïve realism) and interpretivist (relativism) paradigms on the basis of their ontological, epistemological and methodological differences. In all this, IS literature has been mute on critical realism despite Mingers' (2001, 2004b, 2004c) explications on the relevance of critical realism as an epistemological stance in IS research, and its powerful potential for use in the IS field (Carlsson 2012). Recently critical realism has nevertheless begun to gain wider acceptance in the IS field (Mingers et al. 2013). However, many studies are at the conceptual level with few examples of empirical research based on critical realism (Henfridsson and Bygstad 2013).

The ontological, epistemological, and methodological assumptions accompanying positivism, interpretivism, and critical realism are briefly compared before introducing a more in-depth overview of critical realism. The comparison is summarized in Table 1. The researcher is aware of the interest in critical philosophy (Myers and Klein 2011; Orlikowski and Baroudi 1991) and pragmatism (Goldkuhl 2012; Goles and Hirschheim 2000) paradigms as epistemological stance in IS research, but these are subsumed under interpretivism, given the fundamental assumptions of constructivist ontology underpinning these two positions (Butler 1998; Goldkuhl 2012).

Table 1: Paradigmatic Epistemological Stance in the Information Systems (IS) Field Source: (Matthyssens et al. 2013; Mir and Watson 2001; Peters et al. 2013)			
Paradigmatic Elements	Positivism	Critical Realism	Interpretivism
Objective	Description/ Prediction (what)	Causal explanation (why)	Understanding (how)
Finality of science	Identifying universal laws in observations (of actual events)	Expanding knowledge of reality. Accurate causal explanation, bringing the empirical 'in phase' with the real	Meaning-making. Bringing the empirical in phase with the actual.
Ontology	Naïve realism/ epistemological realism of the Aristotelian empiricism persuasion. Reality is apprehensible	Reality is transcendental, stratified and it exists independent of knowledge with fallibilistic apprehension	Multiple and often contradictory realities that are equally valid accounts of the same phenomenon
Epistemology	Objective, remain emotionally detached with the object of study and empirically test stated hypotheses	Epistemic relative but bounded by judgmental rationality. Subjectivist co-creation of meanings that is fallible to construe and not to create reality on the basis of what works for whom, when, and why	Epistemic relative with judgmental relativity. By this, subjectivist co-creation of multiple meanings as the reality is possible
Methodology	Experiments/survey and falsification of hypotheses mainly by quantitative methods. Deductive Inference	Retroductive-based methodological pluralism to exhume causal mechanisms, rejects stereotyping quantitative method as positivism and qualitative method as interpretivism. Engage in intensive and extensive type of methodology with triangulation of methods	Hermeneutical/ Dialectical, impossible to differentiate causes and effects, inductive reasoning; time and context-free are not possible
Axiology (i.e., value)	Research is value-free	Research is value-aware with emancipation/problem solving mindset	Research is value-bound
Rhetorical (i.e., the style of written/spoken communication)	Rhetorical neutrality with formal writing style using impersonal passive voice	Use both impersonal/personal writing style. Empathic, rich, and thick description engraved in philosophical terminology and interjected with critical discourse. Written directly and somewhat informal	Detailed, rich and thick (empathic) description, written directly and somewhat informal

2.3.1 Positivism

Positivism has been a dominant research philosophy in IS research compared to interpretivism (Davison and Martinsons 2011). As Table 1 attests, a positivism paradigm assumes an objective reality that is based on epistemological realism of the Aristotelian empiricism persuasion. What that means is that the senses are the primary determinant of objective reality, with our rational thoughts being subject to our experience (Matthyssens et al. 2013; Mir and Watson 2001; Tsang 2013). Thus,

reality is naïvely apprehensible and definitive knowledge is possible with theories selected to justify the apprehension of such reality. Using statistical methods in data analysis is a major way of establishing a nomothetic body of knowledge among IS studies that subscribe to a positivism paradigm. Consequently, they emphasize the need for precise measurement that is devoid of context. The more the research design is controlled, the stronger the inferences drawn from such design – hence there is the most use of quantitative methods such as questionnaire surveys and experiments (Straub 1989).

The trustworthiness of the positivistic research is mechanized and based on statistical modeling to test hypotheses. It also includes the check of reliability, internal validity, external validity, and cross-context generalization as measures of quality criteria standards (Straub et al. 2004). These quality criteria substantiate the objectivity of the study for acceptance as being rigorous (Straub et al. 2004). However, the danger in this approach is that such studies ‘torture’ the data to “*the role of thin description*”, in order to achieve covering laws that are wedded to the hypothetical deductive model of explanation (Smith 1997, p. 75).

Several anomalies have been identified in positivistic assumptions and its nomothetic research tradition in IS. Among such anomalies are: (1) a reductionist view of causation that is based on correlation between variables rather than causal mechanisms. Thus, it is difficult to explain why the measured correlations exist than might be supposed, and (2) an unsubstantiated assumption of event regularities and explanation that lacks ontological depth (Mingers 2006). Arguably, the most successful theory produced by this tradition in IS research is the Technology Acceptance Model (TAM) (Davis 1989); however, the model could not tell us why the measured correlations exist between variables, thus contributing less to explanatory knowledge in contrast to what the theory is presupposed to do.

2.3.2 Interpretivism

Unlike positivism, interpretivism considers positivistic assumptions in research, particularly in social science, as inadequate (Orlikowski and Baroudi 1991; Tsang 2013). Thus, the interpretivism paradigm has a footstool in the IS field (Walsham

1995) to bring in the social context considered as one of the focal limitations of the positivist approach (Orlikowski and Baroudi 1991). Even with different groups that constitute the interpretivists and the radical postmodernists, their ontological assumptions are remarkably ambiguous, but they all converge on the notion of social construction of reality (Fleetwood 2005). Interpretivism rejects the positivism view of the world and focuses on the cognitive resources of agents as adequate descriptions of the social world (Manicas 1998; Peters et al. 2013). By this, researchers that subscribe to interpretivism focus on peoples' assigned meanings and values to their unique contexts derived from the fluid phenomena they are trying to understand (Klein and Myers 1999; Walsham 1995). In doing that, they immerse themselves with the subjects/informants as mediators to interact with and understand the phenomena under study (Walsham 2006). However, the weakness of interpretivist practice is that it undermines the distinction between appearance and the essence of the reality under study, which most time is misconstrued with the possibility of false consciousness, and the inadequate understandings that agents hold of that reality (Manicas 1998; Peters et al. 2013). Thus, multiple knowledge claims through human creativity are conjectured as laws and, as such, theories are juxtaposed to explain such multiple knowledge (Walsham 2005). Truth is a matter of collective consensus and is relative (Walsham 2005). Interpretivism recognizes two types of relativism, epistemic relativism (i.e., reality can only be known by discourse) and judgmental relativism (i.e., no knowledge claim is better than any other) (Fleetwood 2005). Because of these vulnerabilities, there is production of conceptual explanation in order to achieve understanding (Walsham 1995, 2006).

The notion of social construction of reality allows interpretivism to extend its assumptions to include critical philosophy in an attempt to evaluate and transform the social reality in critical ways (Chen and Hirschheim 2004; Orlikowski and Baroudi 1991). The concern of critical philosophy is with two main issues: (1) *"criticizing existing social systems"*, and (2) *"revealing contradictions that may inhere within their structure"* (Orlikowski and Baroudi 1991, p. 19). Within this critical approach, the relationship between theory (research) and practice is to facilitate the awareness of the restrictive conditions of the status quo with a view to initiating a change in the social relations and practices (Klein and Huynh 2004; Ngwenyama and Lee 1997). In addition, the constructivist ontology of interpretivism

extends to include pragmatism aiming for constructive knowledge that is appreciated for being useful in action (Butler 1998; Goldkuhl 2012).

The diversity of paradigms as epistemological stance in IS research leads to a debate on whether there can be commensurability between different positions (e.g., Orlikowski and Baroudi 1991; Walsham 1995). Some attempts have been made to reconcile the differences among such a diversity by proposing integrated views (e.g., Lee 1989; Weber 2004). Other scholars argue that the paradigms are incommensurable and the methodology based on one epistemological stance cannot be mixed in a given research study (e.g., Orlikowski and Baroudi 1991; Walsham 1995). This debate gave rise to the so-called '*paradigm war*' that took a cultural dimension, where the North Americans were labeled as positivists and Europeans stereotyped as interpretivists in the IS field (Mingers 2003).

This paradigm debate began in the late 1980s, with concerns that the IS discipline had become increasingly fragmented (Hirschheim and Klein 2012; Landry and Banville 1992), with deep-seated divisions, illustrated by conflicts over relevance and rigor (Benbasat and Zmud 1999; Hirschheim and Klein 2003), the roles of structure versus agency, and causation versus meaning in research (Khazanchi and Munkvold 2003). As the paradigmatic debate intensified, Mingers (2004b) proposed that the quest for single paradigm supremacy was not useful, as it obscured progress in the multi-disciplinary nature of IS and the socio-complex phenomena under study. Earlier, Lee (1991), as well as Landry and Banville (1992), had been in the forefront of advocating for multi-pluralistic methodologies in IS research. Consequently, a growing interest in multi-pluralistic inquiry is advocated in the IS field, in line with its popularity in other related disciplines such as management science (Davison and Martinsons 2011).

2.4 Modes of Inference and Thought Operations

The reality under investigation does not speak for itself (Sayer 2000). It needs our logical form of inference or reasoning (i.e., our ability to analyze, abstract, relate, interpret, and draw conclusions) to develop knowledge about such reality (Danermark et al. 2002). Besides, philosophers of science have also emphasized

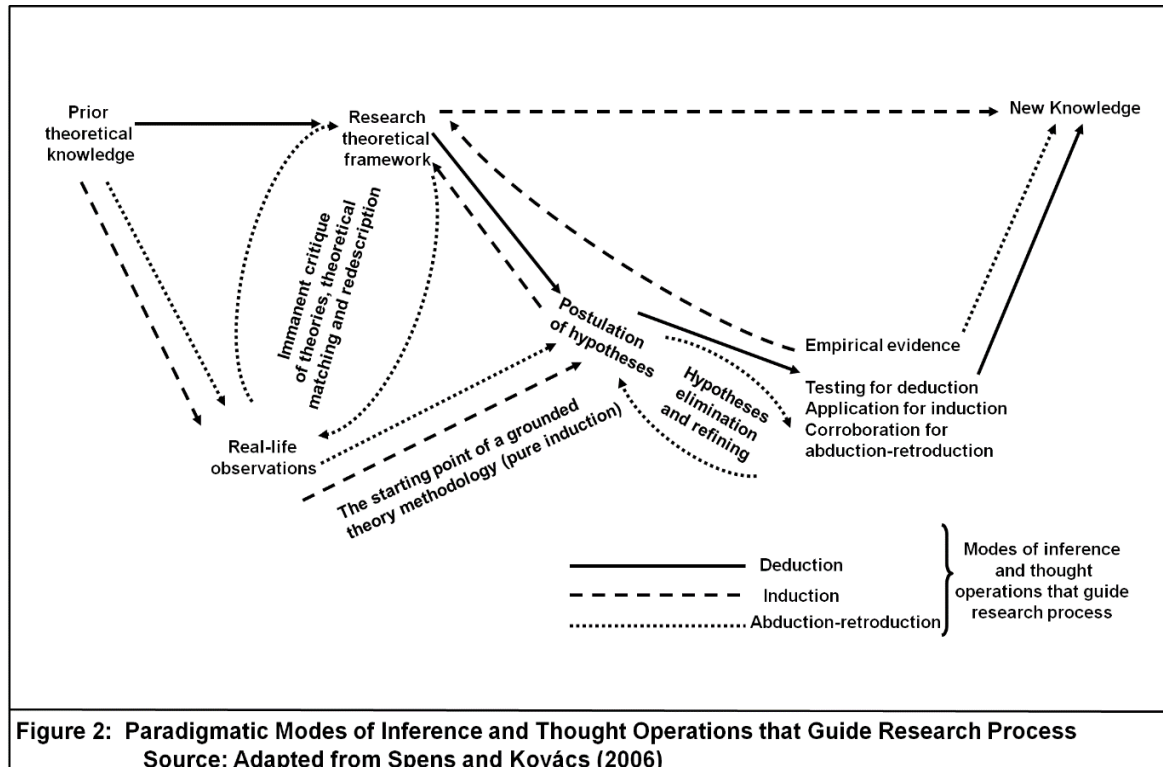
imagination, informed guesses, and creativity in the form of thought operations to develop knowledge about such reality (Danermark et al. 2002). Thus, the logical form of inference or thought operation provides the different ways of arguing and drawing conclusions when we link the observations about the reality we are investigating to the general scientific concepts (Chiasson 2005). The logical form of inference involves reasoning that takes the form of formalized rules for argumentations, whereas the thought operation is the researcher's powers of abstraction, imagination, and creativity as different ways of reasoning, interpreting, and drawing conclusions, without following strictly formalized rules (Danermark et al. 2002). The logical form of inference is captured by deduction, induction, and partly by abduction, while abduction and retroduction take the form of imagination and creativity as the thought operation (Chiasson 2005).

Deduction, induction, abduction, and retroduction are differentiated into four modes of inference. Each of these represents a different logic or a thought operation a researcher uses to develop knowledge about the reality under investigation (Chiasson 2005; Danermark et al. 2002). The four modes of inference are distinct; however, they complement each other in research practices.

Deductive reasoning happens when a researcher derives valid and specific conclusions from given premises and the conclusions must be true if all the premises are true. Sometimes this is called the 'top-down' approach because the researchers start at the top with a very broad spectrum of information and then work their way down to a specific conclusion. With deductive logic a researcher examines the logical validity in scientific argument regardless of which research methods or paradigms the researcher is following (Danermark et al. 2002). Such logic thrives in propositional assertions that not only examine the validity of an argument but also constitute the foundation for hypothetical-deductive method (Danermark et al. 2002; Lawson 2005; Lee 2014).

Deductive logic can be used in different ways in concrete research practice, regardless of the research methods or paradigms (Danermark et al. 2002; Spens and Kovács 2006). For instance, a deductive logic can inform positivist or interpretivist assumptions within a given research process. When such logic informs the

positivistic research process, it might begin with prior literature and/or scanning of existing theories to formulate the research framework, as illustrated with solid lines in Figure 2.



Based on such a research framework, hypotheses are postulated as general laws to be empirically tested for new knowledge generation. The theory so developed can be generalized to a specific instance for a further falsification of the theory in order to arrive at a new knowledge.

The limitation of deduction is that no new thing about reality is discovered than what is already in the premises, while its conclusion is analytical (Danermark et al. 2002; Gregor 2006). Thus, validity of the conclusion is dependent on the strict adherence to the logical rules, which is independent of the reality under investigation (Danermark et al. 2002; Straub et al. 2004). It does not give us any guidance on how we, from observing particular phenomena, can gain knowledge of the abstract mechanisms that make these phenomena possible (Danermark et al. 2002).

The inductive inference works the opposite way when compared to deductive logic (Spens and Kovács 2006). The inductive logic moves from specific observations to

draw universally valid conclusions about a whole population or to draw broader generalizations and theories. The inductive logic helps researchers to see similarities/patterns in a number of observations and, based upon that, draw conclusions that such similarities also apply to non-studied cases. In contrast to deductive logic, the conclusions derived from inductive logic entail addition of new knowledge beyond what is in the premise. Thus, we start from something known and draw conclusions beyond what the something we started with entails. Similar to deduction, induction can be used in different ways in concrete research practice, regardless of the research methods or paradigms (Danermark et al. 2002).

When inductive logic informs the interpretivist research process, it might begin with empirical observations that are ‘devoid of prior theoretical knowledge’ and culminate in postulating hypotheses, as illustrated with the dash lines in Figure 2. Also, the interpretivist research process can also begin with the prior theoretical knowledge/literature and extend to the empirical observations, as illustrated with the dash lines in Figure 2, to capture the interpretivist deductive approach. Then, from the empirical observations, the researcher postulates hypotheses that will be generalized through logical argumentation within a pre-existing theory to form the research framework. The inductive-interpretivist research process favors theory development rather than testing, therefore empirical evidences are applied to strengthen the robustness of the research framework, culminating in the generation of new knowledge. The strength of inductive logic is in ascribing meanings to events in relation to a wider context, while its limitations are that inferences derived can never be either analytically or empirically certain and the conclusions are restricted to the empirical level.

Abduction-retroduction is a valuable logical inference or rather a creative iterative research process. It will be discussed in detail at a later stage of this chapter, but is succinctly illustrated in Figure 2 with dotted lines. Being native to critical realism, abduction-retroduction can start with: (1) a ‘puzzling’ observation, i.e., an anomaly unexplainable by a pre-existing theory, or (2) the deliberate application of literature and theory for explaining a phenomenon (Mingers et al. 2013; Spens and Kovács 2006). In both situations, the researcher must first immerse him/herself in observing the real-life phenomenon under study. Literature that guides such

observation might not be available, and as such the researcher engages in a creative process by bringing in literature from a related area that may seem to describe the case (Okoli 2012; Rousseau et al. 2008).

Abduction allows researchers to interpret and (re)contextualize the phenomenon with a theory in order to understand the phenomenon in a new way, while by way of thought operations, retroduction uses counterfactual thinking to argue towards transfactual conditions (Danermark et al. 2002). It is easy to err in the choice of appropriate theory and, therefore, the researcher engages in theory matching via immanent critique to select a theory or theories that best explain the case (Danermark et al. 2002). Within this process, theory/theories are prone to change especially due to insights that might emerge in the analysis of the initial empirical evidence, which is typical and encouraged. Thereafter, extant theory/theories that suggest matching with the initial empirical evidence and that are coherent with synthesized literature are used to re-contextualize the phenomenon (Bygstad and Munkvold 2011b). Hypotheses are also postulated to form the research model via a retroductive process (Wynn and Williams 2012). Additional empirical evidence is used to retroductively corroborate the research model with the aim of refining the model. Researchers therefore engage in an iterative process of eliminating hypotheses via participants' dialogue that originated in that very context of investigation culminating in new knowledge development (Pawson and Tilley 1977).

The deductive and inductive modes of logical inference dominate the IS field, insomuch that abduction and retroduction is almost forgotten, except for a few studies that use them in critical realist IS research (e.g., Williams and Karahanna 2013), or abduction used in non-realist IS research (e.g., Ngwenyama and Nielsen 2014).

2.5 Critical Realism

Critical realism has been introduced as an alternative to other research traditions owing to its ability to resolve some of the most enduring philosophical debates of modern times. Such philosophical debates centered on the nature of reality, the knowledge of reality and how we may explain observed outcomes. Bhaskar's (1978,

1986, 2008a) intellectual and philosophical reasoning gave birth to critical realism. Bhaskar's works created a critical realist wave in a range of disciplines with some elaboration of its potential in the IS field (Carlsson 2012; Mingers 2004c) despite earlier critique (e.g., Klein 2004; Monod 2004). According to notable IS scholars (e.g., Carlsson 2012; Mingers 2004b; Mutch 2002) critical realism not only mediates between positivist and interpretivist paradigms to douse the philosophical debates; it also positions research practice to capture the complexity of the real world by advocating the use of multi-pluralistic approaches.

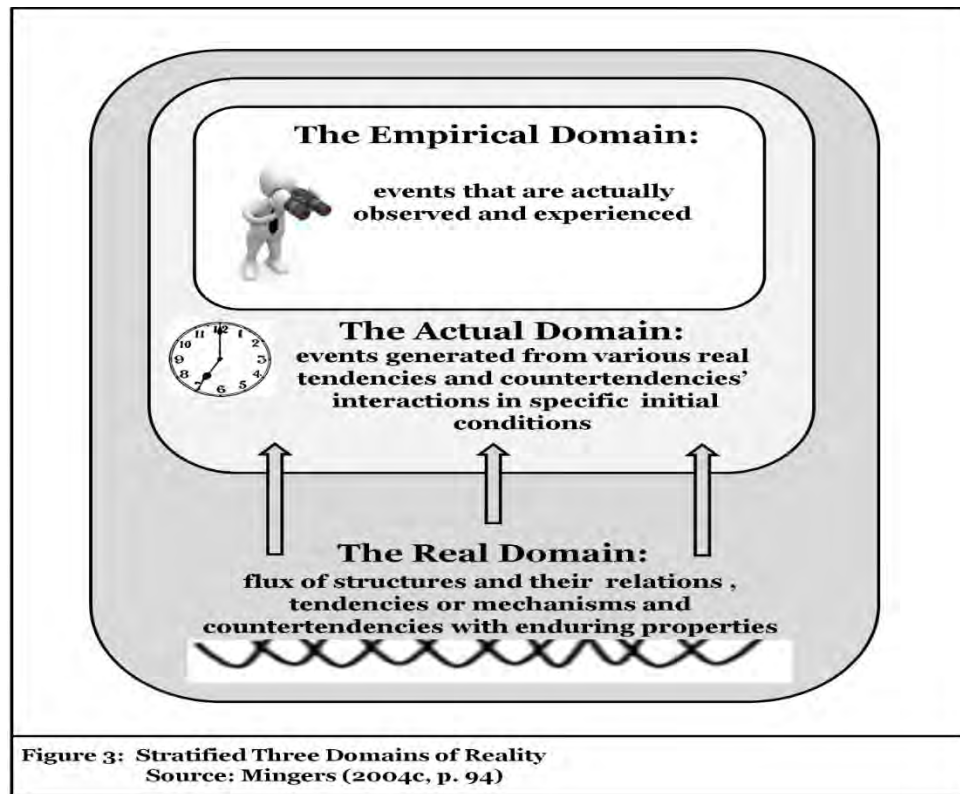
There are three waves of critical realism: (1) The first wave that coalesces transcendental realism and critical naturalism as an attempt to unite natural and social science to form the basic critical realism (Bhaskar 1978, 1986), (2) The second wave focuses on the dialectical critical realism (Bhaskar 2008a). (3) The third wave, termed metaReality (Bhaskar 2000, 2011), follows the spiritual turn. The last is highly contentious and considered by many as a wrong turn (Jessop 2005). This thesis focuses on the first wave of critical realism with reasons explicated towards the end of this chapter. While, not being exhaustive, we explore the concepts of the first wave of critical realism that are fundamental to the objectives of this research: in particular, its conception of ontology, epistemology, and methodology.

2.5.1 Critical Realist Ontology

Ontologically, the first wave of critical realism is based on two sets of assumptions: (1) existence of an independent reality, and (2) a stratified ontology comprising structures and their relations; mechanisms; events; experiences; emergence, and open systems (Bhaskar 2008b). Each of these concepts that constitute the critical realist ontology will now be discussed, starting with the notion of a stratified and differentiated ontology.

2.5.2 Stratified and Differentiated Ontology

For critical realism, the social world is stratified and differentiated into three nested domains – *the empirical, the actual, and the real* (Bhaskar 2008a; Mingers 2004c) as shown in Figure 3.



The empirical domain consists of social actors' subjective understanding of the social world by experiencing the observable events and processes. It is the domain where concepts and interpretations are built to apprehend the experiential world as a possible reality (Bhaskar 2008b; Mingers 2004c). The empirical domain is also the subset of the actual domain where events that yield themselves to observation dwell; we can observe them by perceptions of their multiple effects or by measurements. The next domain, the actual, as a subset of the real, refers to events that occur in the social world when the causal powers of the structures, mechanisms, and their relations are exercised regardless of whether or not they are observed by humans. The real domain refers to structures, mechanisms and their relations with the enduring flux of interactions and causal powers to generate mechanisms that produce events (Mingers 2004c, 2013).

Critical realism 'under-labors' for social science to understand the established and existing connection between the empirical, the actual, and the deeper dimension of reality in a social world. Such understanding allows for causal-base explanations by postulating the mechanisms, structures, and relations in their situated contexts that cause the events and experiences under investigation. For "[t]o ask for the cause of

something is to ask what ‘makes it happen’, what ‘produces’, ‘generates’, ‘creates’ or ‘determines’ it, or, more weakly, what ‘enables’ or ‘leads to’ it” (Sayer 1992, p. 104). The real domain, which generates the causes (Sayer 1992), is classified into four different entities - materially real, ideally real, artifactually real, and socially real entities (Fleetwood 2005). Prior to this insight (i.e., stratified ontology of the social world) by Bhaskar (2008b) and clarified further by other critical realist scholars of various disciplines (e.g., Archer 1995; Danermark et al. 2002; Fleetwood 2005; Mingers 2004c; Sayer 1992), other philosophies such as positivism and interpretivism conflated or denied the existence of these different modes of reality.

2.5.3 Structures

Structures are defined as a “*set of internally related objects or practices*” (Sayer 1992, p. 92), “*that constitute the real entities we seek to investigate in a specific contextual situation*” (Danermark et al. 2002, p. 47). Structures have causal powers to influence events (Kemp and Holmwood 2003). Consequently, structures are real, but may not be actualized at the level of the events. They exist independent of human agency. However, some structures, for example, social structures do not exist independently of human activities they govern; and by such activities they are reproduced or transformed (Archer 1995; Mingers 2004c). In fact, they are the result of human social activities (Archer 1995; Fleetwood 2005). Material structures of IS are also social because they were formed by the activities of humans (Leonardi and Barley 2008).

Social structures do not exist independently of an agents’ conception of their effects (Fleetwood 2005). That is, social structures manifest through the activities they govern and, as such, cannot be directly observed (Fleetwood 2005). Being not directly observable does not mean that their symbolic artifacts do not reveal them to us (Wynn and Williams 2012). For example, retail banking structures in a certain society cannot be observed directly, but the act and experience of withdrawing money from automatic teller machines (ATMs) being the symbolic artifacts reveal that such structures exist. Therefore, our knowledge of such structures is resident in the transitive (i.e., subject-dependent aspects of knowledge) dimension. Because of this, they are mediated by our experiences, values, existing theory, and other social

structures (Wynn and Williams 2012). Also, since power resides in the structures and their relations, both structures and their relations could influence the system potential based on certain mechanisms and circumstances (Bhaskar 2008b; Wynn and Williams 2012).

2.5.4 Causal Mechanisms

Mingers (2011) acknowledges that Bhaskar is actually quite vague in using “*the terms structures, mechanisms, things, powers, [liabilities, i.e., susceptible to the powers of other mechanisms] and tendencies*” (p. 315). Therefore, to guide this thesis, causal mechanisms are defined, in line with Fleetwood (2005), as entities that emanate from the physical, social, ideational, artifactual, or psychological structures and their relations. They are endowed with causal powers or tendencies because of the enduring flux of their interactions to generate outcomes. Such entities or mechanisms outlive the events they generate within a specific context or condition. They implicitly or explicitly make themselves available in a particular setting (i.e., IS innovation) for people to use them in producing outcomes (Carlsson 2003).

Mechanisms that are exercised and actualized may or may not generate events. “*A generative mechanism, we might then say, is that aspect of the structure [or entities] by virtue of which it has a certain power*” (Collier 1994, p. 62). Power here is defined as what an entity possesses by virtue of its intrinsic structures; this power endures, whether or not it is exercised or actualized. Mechanisms exercise powers and tendencies to transfactually transfer energy, information, or matter to other entities to realize events. In so doing, they change the affected entity’s characteristics and propensities in ways that endure until counteracted by other mechanisms (Bhaskar 2008b).

Mechanisms have unique characteristics sensitive to variations in context, and they produce effects because of their interactions. Such effects are not inherent in any of the mechanisms (Mingers 2004c; Wong et al. 2013). Consequently, mechanisms are used to develop mid-range theories (Merton 1968). Such theories explain an event, which is to give a fallible account of why it happened as it happened. To understand the relationship between context and outcome, critical realists also use the concept of

generative mechanisms. Thus, generative mechanisms are also “. . . *underlying entities, processes, or structures which operate in particular contexts to generate outcomes of interest*” (Astbury and Leeuw 2010, p. 368).

Mechanisms exist in a concerted manner along the causal chain (Fleetwood 2011). They may or may not be observable (Fleetwood 2011; Steinmetz 1998). Because of this, more than one mechanism could be responsible for a single outcome. Thus, critical realists employ judgmental rationality to select the one with the greatest explanatory power. Being unobservable does not mean that a mechanism cannot be described (i.e., theory-laden description). Such a description is done through the mechanisms’ effects (Fleetwood 2002), “*for causal powers, for example, can only be known not shown to exist*” (Bhaskar 2008b, p. 177). The term ‘describe’ as used here is to “*give an account of its intrinsic properties of and therefore, unobservable mechanisms can be known, and hence described*” (Fleetwood 2002, p. 40). For example, material objects of IT are not observable but, by the use of kernel design theory, their intrinsic properties or intrinsic enabling conditions and structural features are known (Hanseth and Lyytinen 2004; Leonardi 2011). From this, software designers develop algorithmic codes around the IT’s intrinsic properties and structures, giving the enabling conditions, to realize certain events or goals (Polites and Karahanna 2013).

Mechanisms as causal laws govern the flux of events in an open system such as the social world, and not by regularity-based laws as supposed by David Hume (Bhaskar 1979; Fleetwood 2011). Mechanisms, rather than variable-based factors, hence become the building blocks of explanatory theory development and they are central to causal explanation (George and Bennett 2005). Mechanisms are also entities that explain the essence of outcomes or why they occur. They are distinct from factors that describe or characterize variable outcomes captured as quasi-regularities or demi-regularities (Archer 1998b; Lawson 1997).

Attempts have been made to group mechanisms into common categories, based on studies that draw from Coleman’s (1986, 1994) classic macro-micro-macro model of social action (e.g., Avgerou 2013; Hedström and Swedberg 1998). Hedstrom and Swedberg (1998) classify mechanisms into three interrelated types: (1) situational

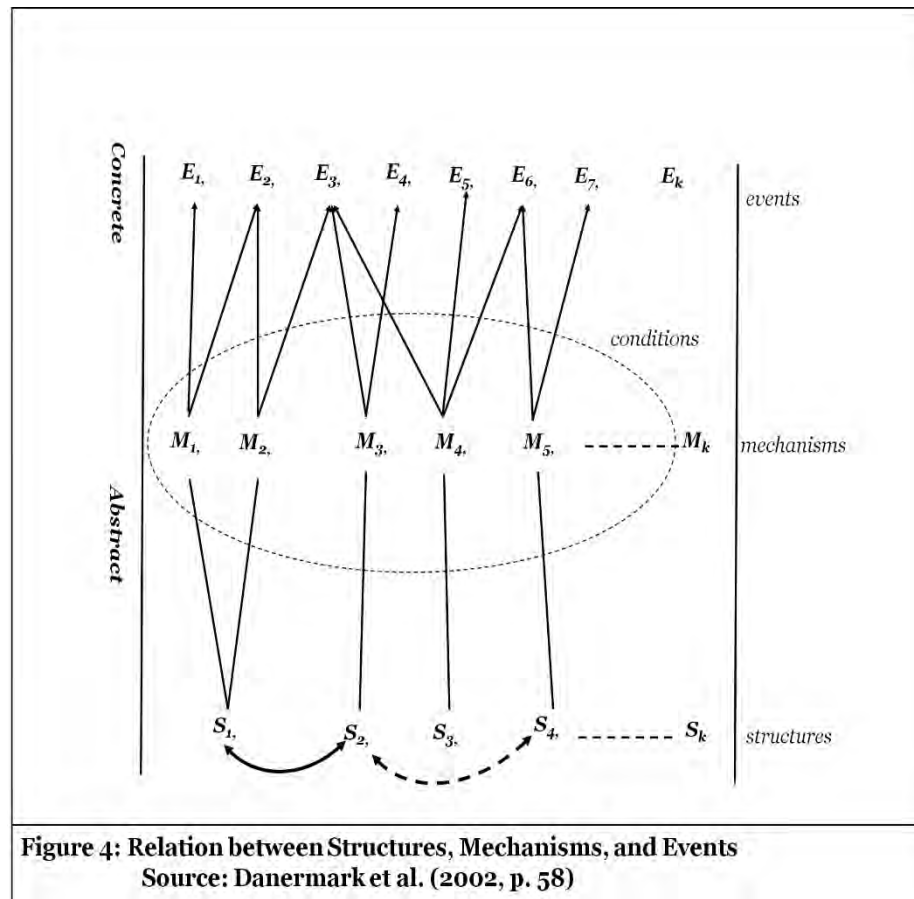
mechanisms; (2) action-formation mechanisms; and (3) transformational mechanisms. Situational mechanisms are operational mechanisms within the macro-to-micro level. Such mechanisms show how the specific social situation or events influence the beliefs, desires, and opportunities of individual actors (e.g., influence of material structures of IS, or organizational structure on individual IS uses). Action-formation mechanisms operationally occupy the micro-to-micro level, where individual choices and actions are influenced by specific combinations of desires, beliefs, and opportunities (e.g., cognitive dissonance mechanisms). The transformational mechanisms operate at the micro-to-macro level, where collective individuals' actions and interactions generate macro level outcomes (e.g., herd behavior mechanisms that manifested in the 'Arab Spring' in using social media to unseat a dictatorial government).

2.5.5 Events

Drawing from Bhaskar's (2008b) stratified ontology and if particularized to the case under investigation, the emergent usage of adaptive IS could be assumed to be the event that occurs (i.e., the specific happening) by the enactment of a set of certain constellations of causal mechanisms. The event in question is ontologically distinct from the structures and mechanisms that produce them (Bhaskar 2008b; Mingers et al. 2013). Events represent the effects mechanisms produce when in interaction and such events could be described by some factors. The effects can wane because of the presence of some dysfunctional mechanisms working in 'conjuncture' with other functional mechanisms in the same context. It is also possible that the effects of a certain mechanism could exacerbate other exercised ones in a certain event (Wynn and Williams 2012). This might further influence the direction, magnitude, and perceptibility of the event. An event may or may not be noticeable, since they are domiciled in the actual domain. They are noticed either by abstraction through their effects or by perception and experience, providing an avenue for science to retroductively uncover the mechanisms that are in charge of such events (Mingers 2010).

2.5.6 Relations between Structures, Mechanisms, and Events

The relationship between structures, mechanisms, and events are diagrammatically shown in Figure 4.

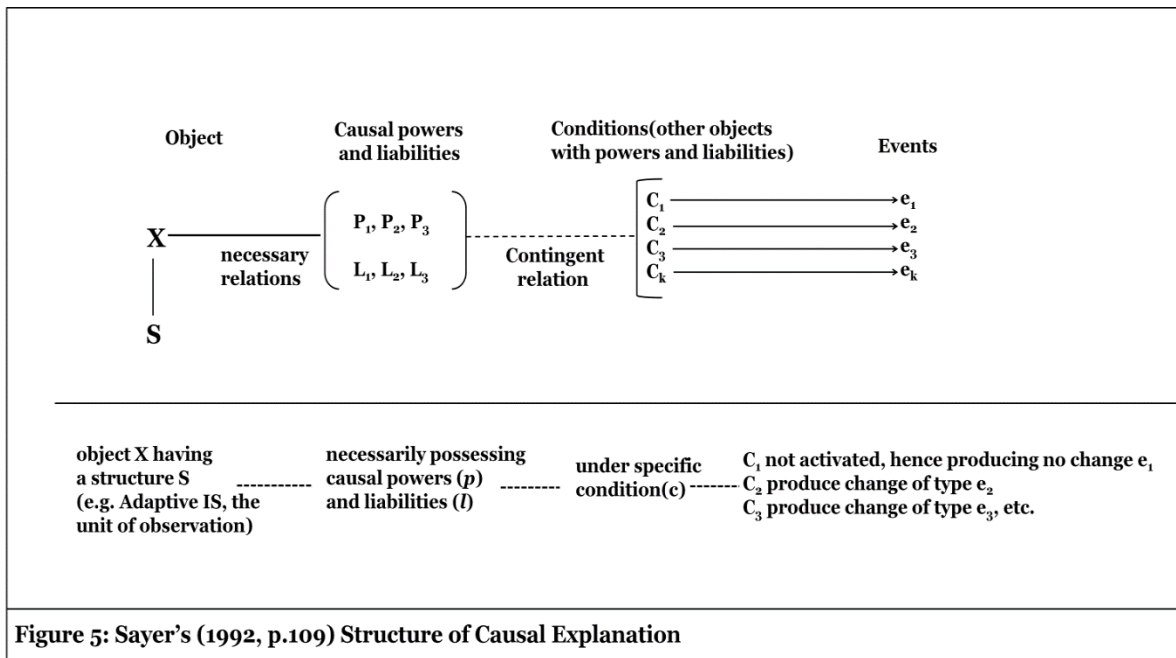


Typically, it is practically impossible to identify the very structure or mechanism behind the event and to eliminate all other alternatives by observing the event. Our task as researchers is, therefore, to go beyond the event by adopting theory-led abstraction to isolate the constituents of the phenomenon. The concept of 'abstract' or 'abstraction' does not suggest 'vagueness' or 'unreality' but an act of isolating an essential aspect of what could cause the concrete event (Sayer 1992).

The thick arrow in Figure 4 connecting the two structures represents the necessary relation. The dotted arrow represents the contingent relation between two structures. The term contingent holds a different meaning here from what we used to know (i.e.,

‘to be dependent upon’); instead, it means not necessary, but could be possible and in fact essential for structures with the potential to have that kind of relation for some sort of mechanism to be actualized (Sayer 1992). For example, the relation between a seller and a buyer is necessary (i.e., no seller exists without a buyer) for exchange mechanisms to be exercised, but the seller, in sending goods via air flight instead of by road for speedy delivery of goods to the buyer, is a contingent relation to activate the seller-buyer trust mechanisms in that kind of relation. In the case under study, the relation between the material structures of IS and its bearers such as computers, smartphones and so on, is necessary for adaptive expectation mechanisms to occur (Faulkner and Runde 2009; Lawson 2008). However, there is a contingent relation between the material structures of IS and the user, by reason of interaction (Faulkner and Runde 2009; Lawson 2008), for a mechanism such as personal innovativeness in information technology (PIIT) to be exercised (Agarwal and Prasad 1998). Therefore, necessary relations are what ‘*must*’ go together, while the contingent denotes what ‘*can*’ go together but do not have to (Sayer 1992). Both necessary and contingent relations are equally important for mechanisms to manifest, for the term ‘*necessary*’ does not necessarily suggest a higher degree of importance when compared to contingent relations in the connected structural entities (Sayer 2000). A necessary relation occurs between two structures or between structures and their powers, while contingent relations can occur between the powers of structural entities and their effects, or between the powers of structural entities and their surrounding contexts (Sayer 1992).

Similarly, the relations between structures, mechanisms, and events which are the building blocks of explanatory theory can also be expressed in Sayer’s (1992) causal explanatory model, as shown in Figure 5. Based on this model, we are exploring the emergent usage events which are also created by the causal powers (p) and liabilities (l) from the structures and mechanisms of object X. In the case under investigation, the object X is the adaptive IS for e-financial services, which can also produce events by having a wide range of conditions (c) in which the object X is situated.



The necessary relations between structures in the research context exist by material structures of IS, process, organization, and people using the technology in their various contexts.

2.5.7 Experience

Consistent with Bhaskar's (2008b) stratified ontology, experiences are domiciled in the empirical domain and such experiences denote those events we can observe or perceive through our senses. Events in the actual world cannot be perceived without leaving empirical traces, and it is the empirical traces we perceive as experiences, not the actual events. Our perception is also fallible because our senses are not always completely reliable (Bhaskar 2008b; Mingers et al. 2013). Direct observation is possible provided it is in a closed-system like a laboratory, where varying external conditions that might thwart the observation are held at bay (Lewis 2000). However, such a direct observation is unobtainable in social systems because of its openness (Bhaskar 2008b; Lewis 2000). Experiences have been the key characteristic of positivism/interpretivism scientific research endeavor, but critical realism scientific research is not based on the experiences per se, but on the mechanisms that make the experiences possible (Bhaskar 2008b). Experiences in this study entail the emergent usage/user experience (UX) we observe when users 'actually' interact with

the technology (Mahlke 2007; Olsson 2013) and they are our gates through which we uncover the underlying mechanisms (Easton 2000).

2.5.8 Closed and Open Systems

Bhaskar (2008b) adopts a distinction between ‘open’ and ‘closed’ systems. Closed systems characterize a situation where mechanisms at work operate undisturbed because of the neutralization of outside factors to produce the constant conjunction of events (Collier 1994). Such a situation seldom happens in an open system except in the laboratories, where scientists act as causal agents in experimental situations. A closed system satisfies criteria for stability of empirical relations (Collier 1994), suggesting both regularities of behaviors and a homogeneous – unchanging and uniform – environment (Bhaskar 2008b; Lawson 1997).

Bhaskar’s (2008b) notion of a strict distinction between closed and open systems has, however, faced strong criticism (Kemp and Holmwood 2003); Bhaskar has subsequently accepted Lawson’s (1997) concept of demi-regularities (demi-regs). This concept refers to nonlinear semi-regular patterns of behavior most common in a social reality (i.e., quasi-closed systems). By this, it then follows that there are spontaneous conjunctions of events in social systems after all, though temporary and not universal, as supposed by positivism. These demi-regs are still context-specific within a time frame (Kemp and Holmwood 2003). The presence of demi-regs are significant enough to show, in a glimpse, the causal influence of a mechanism in an open system before being disrupted, as other influences are temporarily balanced or absent (Kemp and Holmwood 2003; Lawson 1997). Thus, in the open systemic phenomenon under study, emergent usage of adaptive IS for e-financial services is classified as a demi-reg event.

2.5.9 Social Complexity and Emergence

According to Elder-Vass (2010, p. 14), “[t]he term ‘emergent’ was coined in 1875 by G. H. Lewes, along with the term ‘resultant’ . . .”. Subsequently, the concept of emergence was ignored in both philosophy and science for a long time (Bedau and Humphreys 2008). Despite such muteness, the notion of emergence is evident in

both the natural and social sciences, with unpredictable outcomes. In natural science, we can illustrate this case with emergence of water (Mill 1900, p. 243), where oxygen and hydrogen components combine in a specific manner to form water that cannot be traceable to individual properties of both gases. Similarly, in social science, emergence occurs – for example, the emergence of value placed on a piece of paper, as money does not come from the face value alone, but also from the broader distribution of socio-economic structures, institutional and legal frameworks in interaction. Evidence of this kind has rekindled the quest to revive the concept of emergence (Bedau and Humphreys 2008; Elder-Vass 2010), to understand the underlying mechanisms responsible for emergence. The recent works of Bhaskar (2008a, 2008b) from the critical realist philosophy find parallels with complexity science (Elder-Vass 2010), as both streams recognize the emergence and its approach to causal powers. Emergence here “*is a synchronic relation amongst the parts of an entity [at the micro-level] that gives the entity as a whole the ability to have a particular causal impact [at the macro-level]*”; this whole is not reducible to its parts and it has the capability of acting back on the micro-level (Elder-Vass 2010, p. 23). The capability of acting back or the self-reinforcing act of the system is what Mingers (2011) termed ‘reciprocal causality’, which critical realism is silent about, but which is amplified in CAS theory (Mingers 2014). Thus, the intertwining of CAS and critical realism concepts offers the possibility of producing a better explanation of emergent phenomena (Deacon 2006; Mingers 2014).

2.6 Critical Realist Epistemology

Epistemologically, critical realism acknowledges two dimensional realms – the intransitive and transitive domains (Bhaskar 1989). The intransitive domain is the realm of the real things, i.e., structures and mechanisms, and these are the things that scientific theories refer to, and are considered to be causally efficacious (Bhaskar 1989). Without this dimension, researchable and observable outcomes would not be possible. The transitive dimension of social science is where the social theories and social construction of knowledge reside (Bhaskar 1989). Because of the existence of intransitive and transitive dimensions, Bhaskar (2008b) adopts a two-faceted position of ontological realism and epistemological relativism. Instead of judgmental

relativism, critical realism insists on a judgmental rationality which preserves the possibility of rational theory-choice (Bhaskar 1986; Peacock 2000).

The ignoring of an intransitive domain to prioritize the transitive domain triggers the epistemic fallacy seen as a chronic, endemic problem of most philosophical positions (Bhaskar 2008b). The epistemic fallacy is the view *“that statements about being can be reduced to statements about the knowledge of it”*, leading to the dissolution of ontology (Bhaskar 2008b, p. 36). The epistemic fallacy is often accompanied with the ontic fallacy, which sees the social aspects of knowledge as non-existing and disregards the fact that knowledge is socially produced by pre-existing social products (Bhaskar 1989). Thus, all knowledge is fallible, but not equally so. Some are closer to be true and, as such, critical realism eschews foundationalism or taken-for-grantedness (Sayer 2004). Though the world is largely known via discourse, humans still assess which accounts are more practically adequate than others via the judgmental rationality. There is always to some extent feedback from the world, due to our practical interventions, which is referentially and performatively expressed by our discourse/language (Sayer 2004).

From a critical realist perspective, the world is more than discourse and the construal of the world should not be conflated with its construction (Sayer 1992). Even socially- produced entities such as concepts, models, or theories, have independence (Fleetwood 2005). *“To acknowledge that most social phenomena are concept-dependent is not to imply as in idealist fashion, that they are dependent on concepts alone, for it takes more than thinking to produce social institutions and practices”* (Sayer 2004, p. 19). For instance, xenophobic reality is not eradicated in South Africa simply because our discourse or knowledge of it is somehow altered or considered by many as ill-conceived. Therefore, knowledge cannot be divorced from its performativity or its degree of ‘practical adequacy’ derived from the non- or extra-discursive realm (Archer 1995). As such, both the intra- and non-discursive realms of the world are recognized by critical realism (Sayer 2004). To understand reality and develop knowledge about it, demands observation and/or experimentation and, most importantly, this is done by practice or practical intervention on it. Observation here is conceptually-mediated since the human mind is not world-independent (Fleetwood 2005).

To perceive the world presupposes the immediate appearance of some sort of pre-understanding in the form of conceptual framework, theory, belief, or a frame of reference, although unnoticed because the human senses by nature are conceptually tainted (Fleetwood 2005). Therefore, most knowledge of reality comes from practical intervention of the reality, its interaction and communication with humans, instead of just observation or experimentation (Sayer 1992). In critical realist thinking, knowledge is not the corresponding image of reality as positivism supposes, but it comes from the interactions between knowledge and reality characterized by some degree of practical adequacy. As such, knowledge is not only referential to reality in the form of description and explanation, but also informs and guides the practice within it. Both knowledge and practice confirm and legitimate each other in a reciprocal fashion, wherein changes in knowledge will also affect practice and vice versa (Sayer 1992).

There are other core epistemological concepts of critical realism, namely, unobservability of mechanisms, the logic of scientific inquiry, and abduction and retrodution inference strategies. Each will be discussed in turn.

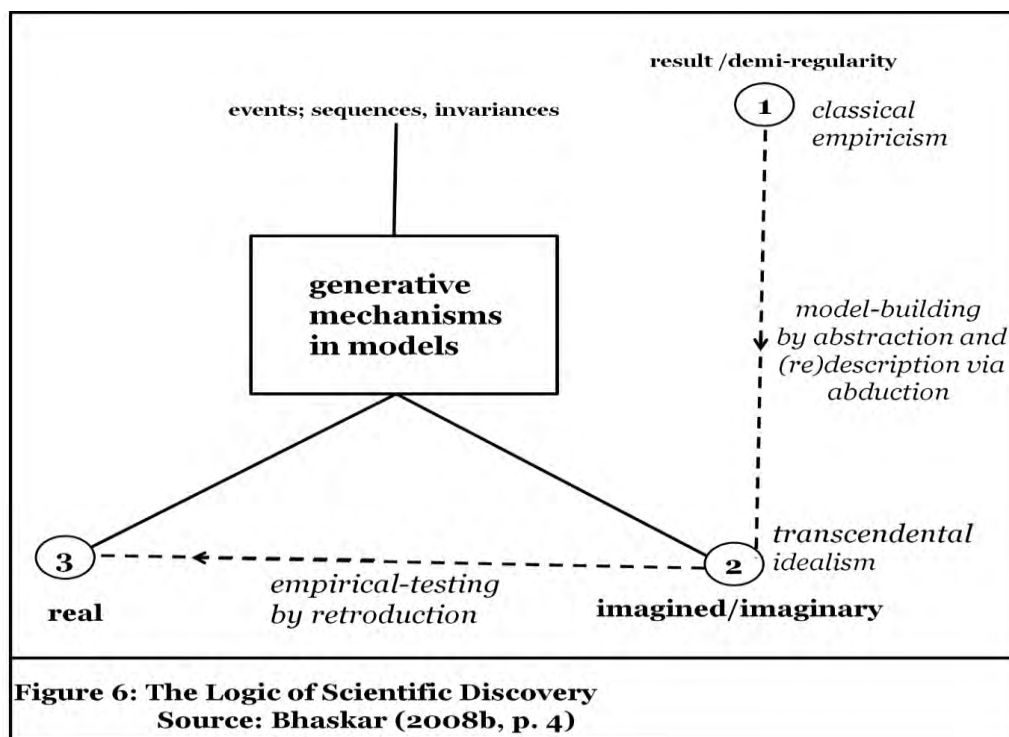
2.6.1 Unobservability of Mechanisms

The unobservability of mechanisms demands that scientific researchers have to put extra effort to make mechanisms observable. This is done by developing new theories or new instruments to make them observable via their effects. Hence, *“observability may make us more confident about what we think exists, but existence itself is not dependent on it”* (Sayer 2000, p. 12). Therefore, knowledge of reality does not only depend on a perception, but also on doing (Bhaskar 1979). ‘On doing’ here means our ability to directly observe mechanisms and their effects (Bhaskar 2008b). By putting effort into understanding their manifested effects, we build knowledge or theories about what might have caused such effects by inference. Therefore, our knowledge of the mechanisms that might have caused observed effects depends upon *“a rare blending of intellectual, practico-technical, and perceptual skills”* (Bhaskar 2008b, p. 37). At this point, we can then make meaning out of these observed effects. To make meaning does not depend on ‘social construction’ but we construe (make sense of) via our cognitive activities of analogization (Fleetwood 2005; Sayer 2000), for the

mechanisms exist only by virtue of the activities they govern and not from the meaning we make of them (Bhaskar 1979).

2.6.2 Logic of Scientific Discovery

The logic of scientific discovering presupposes a three-stage process classified as a transcendental realism in contrast to the empiricism or the transcendental idealism, as shown in Figure 6. From Figure 6, we can see that research practices that align with classical empiricisms stop at the first stage, and that transcendental idealism stops at the second stage.



Bhaskar (2008b) argues that it is only when we take the third retroductive-based stage that we can claim that laws are not assumed to be a constant conjunction of events. Research practices that subscribe to idealism and the transcendental realism also see the need for the step between the first stage and the second stage.

To push forward to the second stage is important because of the involvement of building a creative model via abductively-based theoretical abstraction. Such an abstraction involves isolating the plausible generative mechanisms imagined to produce the phenomena in question (Danermark et al. 2002). Thus, transcendental

realism argues for the need for the step between the second stage and the third stage, in which the reality of the mechanisms postulated is subjected to empirical scrutiny via retroduction. By this, transcendental realism differs from empiricism by interpreting the first stage as the invariance or enduring event, rather than a conjunction of events. Transcendental realism also differs from idealism by inferring that the possibility that what was imagined need not be imaginary in the second stage, but may come to be known as real in the third stage. Therefore, scientific discovery is seen as a process-in-motion. As pointed out by Bhaskar (2008b, p. 240), “[t]his process necessitates the construction of both new concepts and new tools (or the resurrection or refinement of old ones)”. This spans from stage one to stage three in Figure 6, to fulfill the aim of science in discovering the mechanisms that generate the phenomena.

2.6.3 Abduction

Critical realism uses abduction as a thought operation for theoretical (re)description, abstraction, and careful conceptualization (Danermark et al. 2002; Sayer 1992). To do this, we need to ask ourselves qualitative questions such as:

What does the existence of this object (in this form) presuppose? Can it exist on its own as such? If not what else must be present? What is it about the object that makes it do such and such? (Sayer 1992, p. 91)

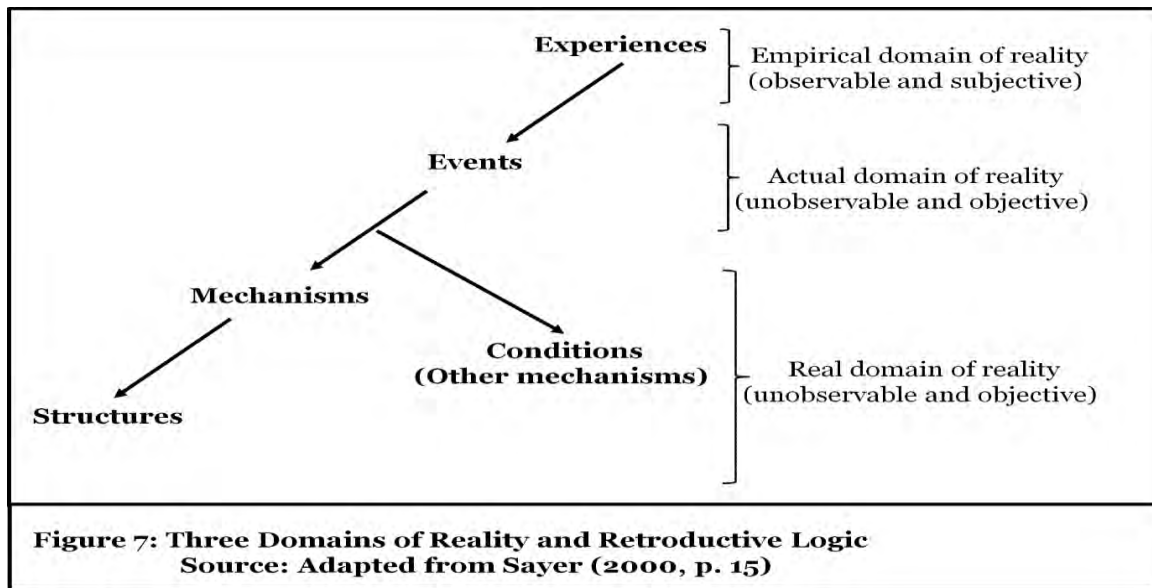
In this study, this could mean asking questions such as: What does the existence of emergent usage in adaptive IS presuppose? Can it exist on its own as such? If not, what structures and mechanisms must be present? What is it about adaptive IS that makes it amenable to emergent usage behavior? By providing answers to these questions, we ultimately provide answers to our research questions RQ1 and RQ2. Sayer (2000, p. 16) maintains that such questions distinguish between “*what can be the case from what must be the case, given certain preconditions*”.

Abduction as theoretical (re)description compels the researcher to re-contextualize the concrete event, using theories to form a hypothetical model or a theory about the structure and relations at play (Danermark et al. 2002). This is done by theoretical

matching against the empirical evidence via immanent or explanatory critique to identify a relevant theory with significant explanatory power (i.e., inference to the best explanation) (Bhaskar 1986; Peacock 2000). This act increases the theoretical sensitivity and the understanding of the concrete event in more depth (Bygstad and Munkvold 2011b). Besides, the process involves theoretical interpretations and explanations of the concepts/constructs and their relations, which tend to approximate the concrete. Such a theoretical interpretations and explanations should be presented, compared, and possibly integrated with one another in the form of theoretical elaboration (Eastwood et al. 2014). By using abduction as an abstracting tool, an event or action can be described or theoretical elaborated in two completely different ways, depending on how it is (re)contextualized within the frame of two different theories (Danermark et al. 2002).

2.6.4 Retroduction

Retroduction entails “*moving backwards*” (Easton 2010a, p. 123), from the observable event we have (re)contextualized during the abduction process to trace the generative mechanisms that make such an event possible. In other words, we move from the observed experiences to postulate the underlying structures and mechanisms that are accountable for the event or phenomenon (Mingers et al. 2013). As shown in Figure 7, the arrow pointing downwards illustrates our moving backward from the empirical domain that is observable to the real domain, to uncover the mechanisms in their situated context.



Since mechanisms may be unobservable, retroduction is used as a retrospective inference of such mechanisms from actors' descriptions of their experiences. Lawson (1997) metaphorically gives an insightful description of retroduction:

If deduction is illustrated by the move from the general claim that 'all ravens are black' to the particular inference that the next one seen will be black, and induction by the move from the particular observation of numerous black ravens to the general claim that 'all ravens are black', retroductive . . . reasoning is indicated by a move from the observation of numerous black ravens to a theory of a mechanism intrinsic (and perhaps also extrinsic) to ravens which disposes [or causes] them to be black (Lawson 1997, p. 24).

So, critical realism rejects the notion that either deduction or induction is sufficient enough to develop a robust scientific knowledge of explanation. Causes have nothing to do with the number of times they have been observed to occur or they have been conceptualized or had a language about them (Sayer 2000).

Methodologically, retroduction is a transfactual (i.e., beyond empirical facts) counterfactual thinking process that involves *abduction-deduction-induction* cycles to look for mechanisms that are not in our minds but in reality, for they can exist independently of our search for knowledge (Chiasson 2005; Danermark et al. 2002). The *abduction-deduction-induction* cycle begins by bringing up 'new ideas' from an anomalous real-life event or even from literature by means of abduction, then we use

deduction to explicate it further and evaluate the aspects of these new ideas and, finally, we use induction to secure these ideas by providing event data to be explained and to test the explanations (Chiasson 2005; Easton 2010a). The cycles (i.e., abduction-deduction-induction) are repeated until we come to the conclusion that we have the mechanism, by continually asking the question, why the event happened in such and such a form, and what makes it to be possible, with the apprehension that the event is an open systemic event (Chiasson 2005; Easton 2010a).

Moreover, by engaging in a retroductive process, contingent relations are filtered from necessary relations existing between the object and the events they produce (Sayer 1992; Yeung 1997). We need to undergo such a filtration because “[n]either objects nor their relations [as well as their causal mechanisms in which they are implicated] are given to us transparently; their identification is an achievement and must be worked for” (Sayer 1992, p. 88). Given that abduction and retroduction are distinct modes of inferences but share some common views (Blaikie 2008), Bhaskar (1983) advocates for the unity of the retroductive and the abductive process. This is due to the biases of social actors’ interpretations of their actions in exhuming the motives behind their actions or experiences.

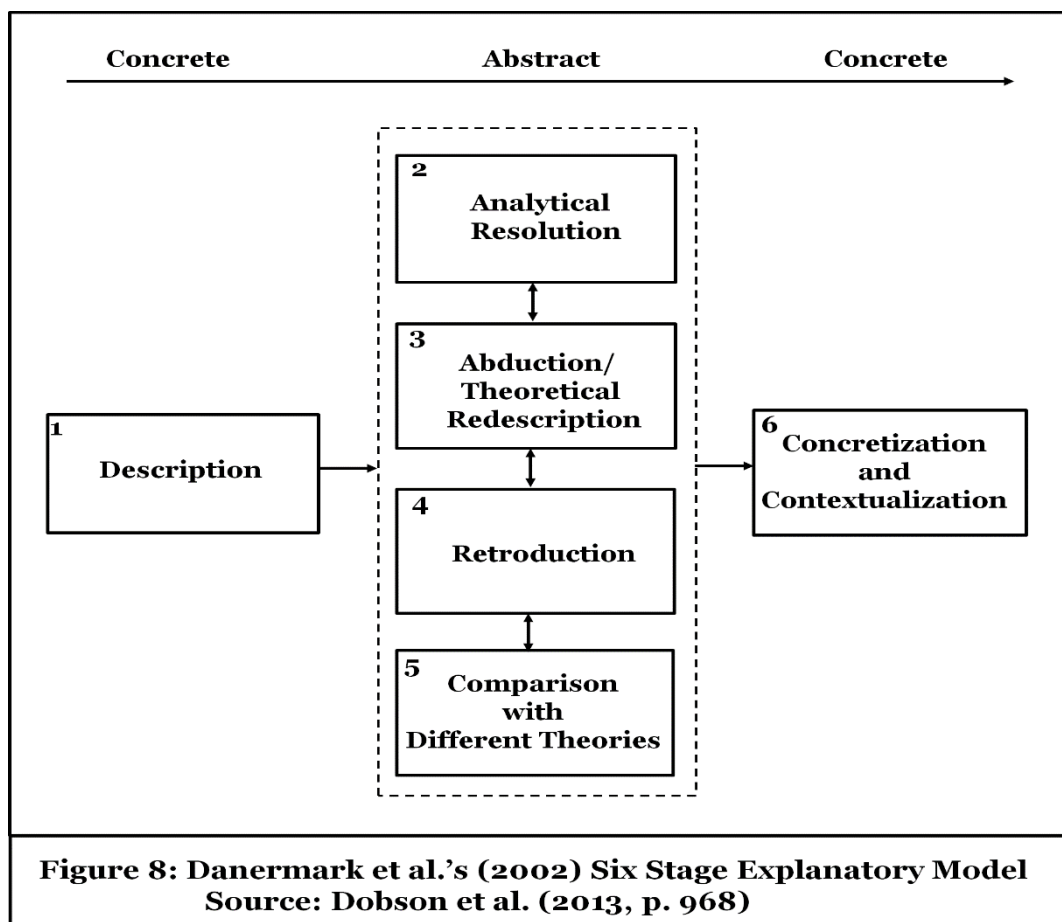
2.7 Critical Realist Methodology

Critical realism methodology hinges on methodological eclecticism and pluralism because of the realist ontological and constructivist epistemological presuppositions (Zachariadis et al. 2013). This encourages a dialectical approach to social research and leaves open the choice of methodology to the creative prowess of the researcher, within the confines of critical realist assumptions, to answer research questions (Lopez and Potter 2001). To engage with a critical realist methodology in investigating observable events, there are several research frameworks to be used to guide the research practice. These include: (1) the Transformational Model of Social Activity (TMSA) (Bhaskar 1979), (2) the Research Map (Layder 1993), (3) the strategic relational approach (SRA) (Jessop 2005), (4) Archer’s (1995) morphogenetic approach (5) Pawson and Tilley’s (1977) realistic evaluation framework, and (6) Danermark et al.’s (2002) six-stage explanatory model. Danermark et al.’s (2002) model is singled out as the research framework-in-use,

because it resonates with the process that will lead to answering the research questions.

2.7.1 Danermark et al.'s (2002) Model

Danermark et al.'s (2002) six-stage model for the social science discipline (the thesis's focus) stems from Bhaskar's (2008a) DREI methodology: D= describe the events of interest; R= retroduce explanatory mechanisms; E= eliminate false hypotheses; I= identify the correct mechanisms (Mingers et al. 2013). However, in the IS field, such a six-stage model has been adopted in its pure form or adapted by IS scholars (e.g., Bygstad and Munkvold 2011b; Dobson et al. 2013). In this thesis the researcher prefer to adopt it, as shown in Figure 8 and Table 2, for its description.



The model assumes that the “*fundamental structures of an explanatory social science can be described as a movement from the concrete to the abstract and back to the concrete*” (Danermark et al. 2002, p. 109). Before describing the six stages,

there is a need to note that the model is not a template to be strictly followed, since research processes are structured differently. Every stage, with the exception of stage 1, involves a swing between different levels of abstraction. The six stages are described with respect to the research context in Table 2.

Table 2: Description of Danermark et al.'s (2002) Six Stage Explanatory Model	
Stage	Description as Particularized to this Thesis
Stage 1: Description	By starting with the concrete i.e., emergent usage of adaptive IS for e-financial services, the focus is on isolating the concrete in order to describe it by making use of everyday concepts. Such a description enables the IS innovation in question, its contextual environment and the nature of its usage to be explicated. Exploratory case-study design discussed in Chapter 5 and its findings discussed in Chapter 6 is used to fulfil this stage in this thesis.
Stage 2: Analytical Resolution	The concrete is dissected into various components. In the case under study, it involves identifying the components of emergent usage of adaptive IS. Such components are the experiential factors which also exist within the e-financial ecosystem where the technology is situated and functions. These components should be accounted (Bygstad and Munkvold 2011). The experiential factors are identified and discussed in Chapters 7 and 9.
Stage 3: Theoretical re-description (Abduction)	The concrete is redescribed using theories about the structure and relations. This stage, thus, corresponds to what has been described under the abduction section of this Chapter and applied in the form of theoretical redescription in Chapter 7. Thus, the original idea of emergent IS usage is developed and placed in its new context with several theoretical interpretations compared and possibly integrated with one another as drawn from theories of CAS and meta-design.
Stage 4: Retrodution	Having now abstracted the different structures, mechanisms and conditions that must exist for emergent IS usage to be possible in stage 3, they are retroductively postulated as what must exist? Such postulations are furthered by using a concrete research process (i.e. case study) to corroborate them. Thus, in research practice, stages 3 and 4 usually overlap. This execution of this stage is reflected in Chapters 7 and 8.
Stage 5: Comparison Between Different Theories and Abstractions	This stage can also overlap with stage 4. Researchers can conclude on the sufficiency of one theory in theoretically redescribing the event or engage in multiple theories, which may be complementary or contradictory. Theory/theories need to be selected because of their greater explanatory power when compared to other competing theories as shown in Chapter 4.
Stage 6: Concretization and Contextualization	This stage involves explaining how the empirically identified structures and mechanisms interact, and manifest themselves in the concrete event under specific conditions as shown in Chapter 10. We utilize the elimination process by using our mind as an <i>experimental laboratory</i> for social science (Bhaskar 1979; Miller and Tsang 2010) to filter-out the structures/mechanisms considered as accidental in collaboration with the views of the informants who are natives in the context under study (Bygstad and Munkvold 2011; Pawson and Tilley 1977).

2.8 Research Methods in Critical Realism

Since critical realism strongly endorses methodological fluidity depending on the research question, it then follows that different methods could be triangulated during empirical research (Wynn and Williams 2012). *“Because different methods focus on different aspects of reality, combining several methods together in a research program yields a rich understanding of the phenomenon of interest”* (Miller and Tsang 2010, pp. 150-151). Critical realist research design places context as *“intrinsically involved in causal processes”* (Maxwell 2004, p. 247). Context must

not be considered as a set of extraneous variables such as in many positivist research practices. Following the recognition of context, contingencies, and qualitative change (Pawson and Tilley 1977; Sayer 1992), critical realism offers itself to “. . . *qualitative analysis of [a reality] . . . to disclose mechanisms*” (Sayer 1992, p. 179). To further strengthen this conviction, critical realists devise their own variant of qualitative research, termed ‘intensive design’ (Danermark et al. 2002; Sayer 1992). Besides, they also have a quantitative research variant called ‘extensive design’ (Sayer 1992), having recognized that the use of quantitative methods can reveal important empirical manifestations of mechanisms (Mingers 2006). Research designs that adopt mixed-method approaches, with the combination of intensive and extensive designs to complement each other, are also encouraged in critical realism (e.g., Zachariadis et al. 2013). As pointed out by Miller and Tsang (2010, p. 151), deploying mixed-method design “*will cope with the complexity of studied phenomena, aspects of which may go undetected by any single research approach*”.

2.8.1 Intensive and Extensive Research

The intensive research design is different from traditional qualitative research design by being driven by theory-led research questions rather than method-driven (Dunn 2012). Such a research design allows theory-driven data collection and analysis that focuses on generative mechanisms, evident via dialoguing with participants (Pawson and Tilley 1977; Smith and Elger 2014). Intensive design is best used to seek, analyze, and explain the mechanisms causing the empirical situation (Danermark et al. 2002). Its sampling techniques are purposeful and strategic. By this, a researcher is typically restricted to a critical and unique case where prevailing generative mechanisms are obvious (Danermark et al. 2002). Besides, while seeking for mechanisms, common characteristics of the phenomenon can be described by using extensive research designs such as through survey and descriptive statistics (Mingers 2006).

2.9 Critical Realism in IS Research

Generally, critical realism in IS research has been very limited, although published instances of it have increased in recent times (Vega and Brown 2011) and can be

classified into five streams. The first stream focuses on the underlabouring role of critical realism in IS. Such studies are mostly conceptual in nature with a focus on how critical realism can overcome the theory-practice inconsistencies and epistemic fallacies of positivist and interpretivist research practices (Smith 2006). Scholars within this group include Carlsson (2004, 2012), Dobson (2001b), Mingers (2004c), Smith (2006), Mingers et al. (2013), Mutch (2002) as well as Ononiwu and Brown (2013). Their work further enlightens us on the potential of critical realism in IS research in resolving some of the problems associated with, for example, the duality of structure in IS research (Carlsson 2012; Mutch 2010b), the dilemma of agency and structure when studying the social-technical nature of IS (Carlsson 2012; Mutch 2013), and the difficulty of conducting micro-macro levels of analysis (Carlsson 2012). Besides, there are other conceptual studies that focus on the appropriateness of critical realism to study specific IS phenomena such as IS design (Carlsson 2005, 2010), operational risk-aware information systems (ORISs) to address operational risks in organizations that are highly risk-prone such as banks (Rotaru et al. 2009), and users' information-seeking behavior in search engine websites (Wikgren 2005).

Following this is the second stream of research that is grounded in Archer's (1995) morphogenetic approach. For example, by using the morphogenetic approach, some studies have proven the import of critical realism in better understanding adoption of information and communication technology (ICT), where macro structures and individual reflexivity often explain the adoption decision (Dobson et al. 2013; Mihailescu et al. 2013). Other studies using the morphogenetic approach are in the areas of technology-mediated organizational change (Volkoff et al. 2007) and the complexity of implementing ICT projects in a developing country (Muranga and Merali 2013). Only the reflexivity concept of the morphogenetic approach is used to investigate ICT-mediated interactions in the organizational settings (De Vaujany 2008; Mutch 2010a). The TMSA of Bhaskar (1979), which is similar to Archer's (1995) morphogenetic approach of social transformation, has been used by Faulkner and Runde (2013) to develop a systematic theory of the nature, position, and identity of technological objects.

The third stream consists of scholars who ground their work in Pawson and Tilley's (1977) realist evaluation framework. This stream of research regards IS phenomena

as social interventions with the potential to cause (desired) changes (Carlsson 2003). IS empirical studies in this stream include the perception of users on the impact of IS on health practice (Oroviogoicochea and Watson 2009), the design of synchronous e-learning (Hrastinski et al. 2010), and emergent IS usage (Tona and Carlsson 2013). Generally, scholars within this stream seek to understand for whom, why, and in what circumstances (contexts) mechanisms cause the changes or emergent events under observation.

The fourth stream of critical realist IS research explicitly or implicitly imbibes Danermark et al.'s (2002) model to uncover generative mechanisms in information infrastructure (e.g., Bygstad 2010; Henfridsson and Bygstad 2013), the development of a mechanism-based theory of IT-associated organizational change (Volkoff and Strong 2013), the uncovering of coordination mechanisms that generate effective IT governance structures (Williams and Karahanna 2013), and mechanism-based explanations of how big data come to matter in the specific business of a telecom organization (Aaltonen and Tempini 2014). Besides, there are other critical realism empirical attempts in particular IS issues, for example, the life cycle of strategic IS planning (Morton 2006), IS investment decisions (Fox 2009), and implementation of automated performance management systems (Dobson et al. 2007).

The fifth stream of research that is currently emerging includes studies that investigate the methodological implications of critical realism in IS research. For example, Wynn and Williams (2012) developed principles for conducting critical realist case-study IS research while Zachariadis et al. (2013) uncovered the methodological implications of critical realism for mixed methods research.

2.10 Reasons for Choosing Critical Realism

Reasons for choosing critical realism in this study provide an answer to the '*so what question*' of what has been solidly discussed about critical realism so far. Thus, at this point, a fair understanding of critical realism empowers the researcher to state the reasons for adopting it, especially for the first wave. Galliers (1992) proposes that a researcher chooses the research philosophy on the basis of: (1) the goal of the study such as theory building, or (2) the objectives of the research inquiry. Thus, the

ontological research question such as *Why does emergent usage occur in adaptive information systems?* presupposes a critical realist ontological underpinning and is evident in critical realism being “*characterized as ontologically bold, but epistemologically cautious*” (Smith 2006, p. 200). It reaffirms the importance of the focus on contextual environments, individual experiences, and perceptions being used in inferring the causal mechanisms without denying their existence (Smith 2006; Syed et al. 2009). Thus, critical realism is adopted for solid ontological grounding of this research. By this, the existence of a reality independent of observation is established “*while accepting the relativism of knowledge . . .*” (Mingers 2014, p. 16). Knowledge as used here is “*. . . socially and historically conditioned in the epistemological domain*” (Mingers 2014, p. 16).

Critical realist assumptions will empower the researcher to conduct a critical realist literature review for building theory that explains the phenomenon under study, since literature reviews are not epistemologically neutral (Okoli 2012; Rousseau et al. 2008). Consistent with critical realist perspective, the conceptual framework synthesized from such literature review will be integrated with two other complementary lenses (i.e. theories of CAS and meta-design) to increase the explanatory power of the theories used for investigating the phenomenon (Matthyssens et al. 2013; Miller and Tsang 2010). It will also empower the researcher to conduct immanent critique of rival theories that seem to explain the phenomenon under study.

By drawing a distinction between the events (in this case emergent usage experience [UX] of adaptive IS) and the underlying generative mechanisms that generate such events, critical realism enables the researcher to dig deep via retroductive means to hypothesize such mechanisms from the explanatory/theoretical model of the research which, if they existed, would explain the events as the answer to the research question RQ2 (Mingers et al. 2013). Because of its stratified ontology and its support for interpretivist epistemic commitments, focus is also on the more visible and experiential factors that characterized emergent IS usage (answer to the research question RQ1). One needs to track the more visible and experiential factors to the deeper mechanisms assumed to have caused such factors to exist via a retroductive-explanatory case-study (Vega and Brown 2011).

The critical realist concept of analytical dualism or its view of autonomous structures and agency interaction over time (Archer 1995; Leonardi 2013a) can help to understand how structures of IS condition human action in the technology and how the actions reproduce or transform such structures in a sociotechnical sense, yet are equally real in an ontological sense (Leonardi and Barley 2008; Syed et al. 2009). By this, data can be collected on structures, as well as agency without conflating them (Leonardi 2013a). Agency is considered here as both non-human and human; in the case of human, it is stratified into a person, an agent, and an actor in the environment (Archer 1995; Peters et al. 2013). The concept of a person captures the individual identity as ‘someone who experiences’ the technology, while-in-use, whereas the concept of agent reflects the active role agency plays in reproducing or transforming the technology by reason of design-in-use in order to effect the evolutionary growth of the system. An actor captures the participatory role of a user and a designer in collaborative action within the system’s development until the end-of-life of the application (Fischer and Herrmann 2011). These varied roles of agency, therefore, enable the researcher to collect data on agencies’ experiences, apperceptions, and actions in the technology. Besides, since critical realism facilitates an expansion of epistemological boundaries (Syed et al. 2009), it is possible for the researcher to give due attention to social structures such as organizational structure without losing focus on individual actions, experiences, and perceptions of the technology (Carlsson 2012; Syed et al. 2009).

Finally, critical realism’s pluralist ontology and its commitment to methodological eclecticism (Mingers 2001; Syed et al. 2009) enable the researcher to creatively engage a variety of research methods and theories, and triangulate them in case-study research design of this thesis. Thus, critical realist perspective to adaptive IS uncovers the contingent nature of its emergent usage and its evolutionary growth while-in-use. It illustrates the role of meta-theoretical necessity, but contains insufficient conditions for the scientific causal explanation of the system’s emergent usage that supports a generalizable mid-range theoretical contribution from a single case-study.

2.11 Chapter Summary

Chapter 2 discussed critical realism as a choice and the valuable philosophy underpinning this research. First, it presented the different definitions and versions of paradigms, the philosophical underpinnings and how they have influenced the IS discipline, culminating in multiplurality advocacy in IS research. The chapter briefly discussed the paradigmatic mode of inference driving IS research and the paradigm axiomatic table where positivism, interpretivism, and critical realism philosophy were compared. Thereafter, critical realism ontology, epistemology, and methodology that guided the research were explicated, including the reasons for selecting critical realism for this research. A review of studies that adopted critical realism in the IS field was also presented to highlight the paucity of empirically-based critical realist research in the IS field and the need to fill the gap.

Chapter 3

Literature Review

“Viewing the literature as honoring the past to inform the present gives us the opportunity for it to affect the future.”

(Rocco and Plakhotnik 2009, p. 9)

3.1 Introduction

This chapter discusses the notion of a critical realist literature review, a relatively new strategy for scoping and synthesizing prior studies about a phenomenon in order to achieve a mechanism-based explanatory model. Such a literature review is also called synthesis by explanation in some quarters (Rousseau et al. 2008). It usually starts with review question(s) to focus the investigation (Okoli 2012; Rowe 2014). Thus, the objective here is to synthesize relevant literature of emergent usage of IS from multiple disciplines, in order to unveil the mechanisms responsible for emergent usage of IS and the experiential factors that describe such usage. In so doing, a critical realist conceptual framework is developed that will serve as a starting point for proposing the research agenda for the topic under investigation (Rowe 2014).

A critical realist literature review, as with any other theory-oriented review, can take the form of: (1) framework synthesis where an a priori theoretical framework(s) is utilized to extract and synthesize findings, or (2) thematic analysis, where a thematic conceptual map is developed based on thought perspectives on how the phenomenon has been covered in IS or other related fields (Boell and Cecez-Kecmanovic 2014; Okoli 2012; Rocco and Plakhotnik 2009). Following several other IS scholars (e.g., Roberts et al. 2012), the thematic analysis approach was adopted to conduct the literature review. Such an approach engages researchers' thoughts to systematically

scope, identify, and categorize conceptual content of prior studies and identify relationships among the categories (Roberts et al. 2012; Webster and Watson 2002). To do this, a 4-phase critical realist review argumentative strategy and its description, as shown in Table 4, was proposed. Argumentative strategy as used here is the “[l]ogical structures in the argumentation enacted in . . . [this chapter], the order of the components of the author’s argument” in organizing and synthesizing the literature review (Rowe 2014, p. 243).

Table 3: 4-phase Argumentative Strategy Framework for Applying a Critical Realist Orientation to Literature Review Source: (Danermark et al. 2002; Rowe 2014; Okoli 2012; Rycroft-Malone et al. 2012)	
Phase	Description
Phase 1: A typology of existing theoretical/thought perspectives gear towards synthesizing of the literature and write-ups.	<i>A priori</i> theory/theoretical perspectives or a thematic conceptual map (Roberts et al. 2012; Rowe 2014; Rycroft-Malone et al. 2012) is made up-front and used for the categorization, synthesizing, and writing of the literature. Thematic conceptual map (thematic analysis, the thesis’s focus) allows scoping and categorization of relevant studies from multi-disciplinary domains. It also enables theoretical landscaping while going for theory development in a concept-centric fashion (Barnett- Page and Thomas 2009; Okoli 2012; Rowe 2014; Webster and Watson 2002). Because of these advantages, thematic analysis is the preferred choice for critical realist review (Barnett-Page and Thomas 2009). Before getting to this stage of synthesizing and write-up; methodology for material collection, the purpose of the review, literature search, data extraction, and quality appraisal must have been spelt out in the review methodology as shown in appendix A.
Phase 2: Inferring and identification of the core concepts as generative mechanisms /factors from the synthesized literature.	The key concepts as mechanisms and factors from each of the thematic categories are inferred and identified. Such concepts capture the theoretical/thought perspectives used in synthesizing the literature in Phase 1. The identifications are done in line with critical realist assumptions to achieve the purpose of the review.
Phase 3: Theory-lead thematic coding to develop conceptual framework.	An abductive thematic coding of the concepts from Phase 1 is conducted. This is done in order to develop a critical realist conceptual framework.
Phase 4: Establishing theoretical coherence and re-contextualization.	Establishing theoretical coherence by using the conceptual framework synthesized in Phase 3 as a starting point and integrates extant theories that seem to explain the phenomenon. Engage in theoretical re-contextualization of the phenomenon with the aim of developing a mechanism-based explanatory model that explains the situated context under investigation.

Therefore, the 4-phase argumentative framework is an iterative process and not formulaic, but is only one among many that can help in extracting, analyzing, and synthesizing the literature, based on a consolidation of insights from scholars (e.g.,

Barnett-Page and Thomas 2009; Okoli 2012; Roberts et al. 2012; Rousseau et al. 2008; Rowe 2014; Rycroft-Malone et al. 2012; Webster and Watson 2002). The results from applying Phase 1 of the framework are summarized next. Further detail of the systematic review methodology is shown in Appendix A.

3.2 Phase 1: Existing Perspectives of Emergent Usage of IS

Emergent usage of IS is a collection of specific behaviors that has been diversely understood and, as such, cannot be fully explained by one concept. It has drawn interest from many different fields of research, with each field adopting a slightly different perspective or interpretation of the phenomenon. Following IS scholars (e.g., Roberts et al. 2012), different facets of achieving emergent usage were used for structuring the literature review. These facets are presented as seven themes in Figure 9. Table 4 presents a summary of the existing perspectives on emergent IS usage behavior in relation to Figure 9. As Figure 9 attests, a large number of themes/categories of explanations of emergent usage of IS are identified, without making claim to the exhaustiveness of these themes.

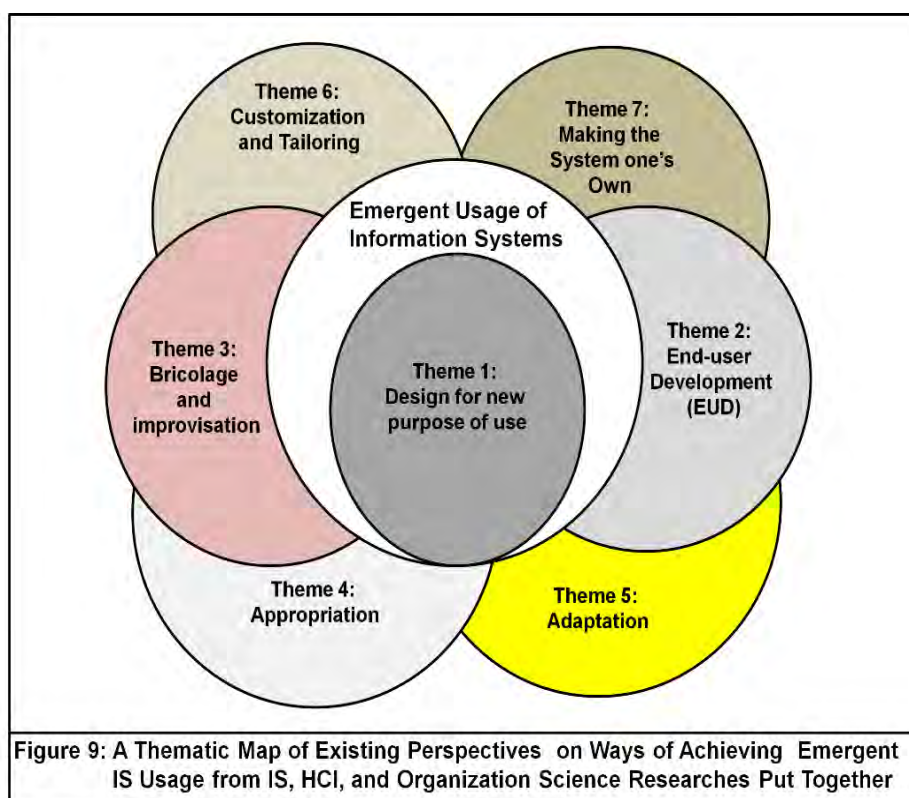


Table 4: Existing Perspectives of Emergent Usage of Information Systems (IS)			
Proposed Typology or Themes	Field of Research	Example Studies	Contexts
Design for new purposes of use	IS as a discipline and Human-Computer Interaction (HCI) field	(Dix 2007; Dourish 1999, 2003; Fischer and Herrmann 2011; Hanseth and Lyytinen 2010; Heeks 2002; Pahlke et al. 2010; Patel 2012; Patel et al. 2010; Patel and Hackney 2010; Perry and Rachovides 2007; Pipek and Wulf 2009; Sengers and Gaver 2006; Tiwana et al. 2010; Wakkary and Maestri 2008; Wulf et al. 2008)	Design in complex IS or information technologies in general.
End-user development (EUD)	HCI	(Ahmadi et al. 2008; Amoroso 1988; Amoroso and Cheney 1992; Asand and Mørch 2006; Barker 2007; Brancheau and Brown 1993; Burnett and Scaffidi 2014; Fischer 2010a; Fischer and Giaccardi 2006; Fischer et al. 2004b; Fischer and Herrmann 2011; Giaccardi and Fischer 2008; Ko et al. 2011; Lieberman et al. 2006; Paternò 2013; Shayo et al. 2002; Zmud 1984)	Workplace systems, Software systems, and Mobile technologies.
Bricolage and improvisation	Organization science	(Boudreau and Robey 2005; Ciborra 1992, 1996, 2004; Ciborra and Willcocks 2006; Hayes 2000; Orlikowski and Hoffman 1997)	Workplace systems and Group-ware technologies.
	IS	(Alter 2014; Arora et al. 2010; Heeks 2002; le Roux 2014; Magni et al. 2010; Molnar and Nandhakumar 2008; Teoh and Wickramasinghe 2011; Tjørnehøj and Mathiassen 2010)	Workplace systems.
Appropriation	IS, HCI, and Organization science	(Bar et al. 2007; Carroll 2004; Carroll et al. 2003; de Souza e Silva et al. 2011; Delaney et al. 2008; DeSanctis and Poole 1994; Dey et al. 2011; Dourish 2003; Fidock and Carroll 2011; Fuller and Dennis 2009; Lindtner et al. 2012; Orlikowski 1992; Rodon et al. 2011; Salovaara 2008; Salovaara et al. 2011; Stocker et al. 2012; Waycott et al. 2005; Wiredu 2007)	Workplace systems, Group-ware technologies, and Mobile technologies.
Adaptation	IS and Organization science	(Ahuja and Thatcher 2005; Barki et al. 2007; Boudreau and Robey 2005; Boulus and Bjorn 2010; Convertino et al. 2007; Davidson and Chismar 2007; Davis and Hufnagel 2007; Desouza et al. 2007; Jaspersen et al. 2005; Mills and Chin 2007; Nan 2011; Park and Chen 2012; Rice and Rogers 1980; Saga and Zmud 1994; Schmitz et al. 2010; Singletary et al. 2002; Sun 2012; Tyre and Orlikowski 1994)	Workplace systems and Mobile technologies.
Customization and Tailoring	IS, HCI	(Germonprez and Collopy 2004; Germonprez et al. 2007; Germonprez et al. 2011; Hovorka and Germonprez 2011; Kwon and Kim 2011; Mathwick et al. 2010; Monk and Blom 2007; Oulasvirta and Blom 2007; Sundar and Marathe 2010; Sundar et al. 2012; Sunikka and Bragge 2012; Tossell et al. 2012; Wulf et al. 2008)	E-commerce and web-based adaptive systems.
Making the system one's own	IS, HCI, and Organization science	(Al Lily 2013; Allen et al. 2011; Barki et al. 2007; Harwood 2011; Hynes and Richardson 2009; Silverstone et al. 1992; Sørensen 2006; Sørensen et al. 2000)	Workplace systems, Home media, Mobile technologies, and Online booking in hospitality industry.

As illustrated in Table 4, within each theme, the context within which the phenomenon occurs spans from IS in workplaces to interactive web-based adaptive systems and mobile technologies. Each of the themes will be discussed in turn.

3.2.1 Theme 1: Design for New Purposes of Use

For emergent usage to occur in a particular software artifact, the original design must support the notion of new purposes of use. This understanding is common in human-computer interaction (HCI) and in a few IS design-related studies (Hovorka and Germonprez 2011; Pipek and Wulf 2009). Both streams of research have strived to advance the understanding of IS that are designed for new purposes of use (Dourish 2003; Pipek and Wulf 2009). Novel purposes are driven by situational needs that might have developed over time or that arise abruptly during a course of action. Suchman (1987) reiterates this position by stating that even in the case of purposeful actions, ‘inevitable situated actions’ exist. When such situated actions occur in IS, user-system interactions are shaped by the ad hoc and local contingencies of the situation (Heeks 2002). Thus, emergent usage can be understood as the technology-based ways to cope with such situations. Besides, such situated action provides a starting point for multi-purposefulness and variability in software design and use (Dourish 2003; Mahdavi-Hezavehi et al. 2013; Patel and Hackney 2010; Pipek and Wulf 2009; Tossell et al. 2012).

Pipek and Wulf (2009) advocate for versatility and reflexivity in design for new purpose of use to emerge. They do that by drawing from sociotechnical theory and the infrastructural notion of IT (Hanseth and Lyytinen 2004; Star and Ruhleder 1996). Versatility in its own right is not explicitly seen in the design, but it anchors users’ opportunities “*to modify and appropriate different parts [of IS] in ways unforeseen by [its] . . . designers*” (Pipek and Wulf 2009, p. 54). Reflexivity tends to blur the gap between designers and users where software, for instance, work service-systems (Alter 2010b), come to exist by the collaborative actions of both the designers and the users. Designers build on emergent usage possibilities through reflexivity and create improvements in the system’s fault tolerance to support users’ future adaptation (Pahlke et al. 2010; Tekinerdogan et al. 2012).

Similar suggestions about emergent usage possibilities in IS are made in HCI studies (e.g., Dix 2007; Dourish 1999, 2003) without leaning on a specific theory. Such suggestions inspire people to design software that has practical relevance, spanning individual and societal contexts-of-use. Dourish (1999) suggests five design

principles that could support new purpose of use in adaptive IS. These include flexibility, incremental adjustments, user community, visibility of users, and persistence. Flexibility captures the openness of the system for different kinds of contents and purposes where users are provided with control possibilities for customizations. Naturally, such possibilities follow incremental adjustments to accommodate transformations-in-use. Because Dourish's (1999) context is groupware technology, emergent usage is seen as a process of social appropriation. Thus, designers take into account the user community with features that promote visibility of users' action for sharing novel practices (Dix 2007). The transformative usage of systems also presupposes that the system manifests persistence, preserving a previous system state, on which later adaptations can be built (Dix 2007). Playfulness and exploration are other desirable features suggested to foster the discovery of novel purposes of use (Perry and Rachovides 2007). The introduction of ambiguity into the system's purposes of use, especially in game technologies (Perry and Rachovides 2007), forces users to engage in sense-making and reinterpretation of the system's functionality with possibilities of arriving at uses that were not expected (Gaver et al. 2003; Sengers and Gaver 2006).

From a usability point of view, Hanseth and Lyytinen (2010) adopt the CAS theory to propose simplicity and multi-functionality as design features that could support new purposes of use. Simplicity and multi-functionality are considered to be in equilibrium to overcome bootstrap and adaptability problems in adaptive IS (Hanseth and Lyytinen 2010). Bootstrap problems constrain early users to use the system and, therefore, designers should create service value attractors that could lead to users' lock-in. When such service attractors occur, adaptability issues also arise to constrain users' unforeseen and diverse demands of the system's features to achieve a particular goal (Pahlke et al. 2010; Patel 2012). Simplicity, modularity, and flexible IS architecture are a set of factors that are proposed as design features to confront such adaptability issues (Hanseth and Lyytinen 2010; Heeks 2002; Tiwana et al. 2010; Wulf et al. 2008). Simplicity and modularity are argued to power the infrastructural flexibility so that the system adapts technically and socially (Hanseth and Lyytinen 2010; Pahlke et al. 2010). Consequently, designers usually struggle to keep simplicity and adaptability in equilibrium because adaptability is intrinsically linked to multi-functionality and achieving one goal often leads to relegating the

other (Hanseth and Lyytinen 2010). However, when such equilibrium is near-achieved in practice, the tendencies for users to customize and modify the technology to achieve their everyday needs are much higher (Wakkary and Maestri 2008).

Patel et al. (2010), as well as Patel (2012) use the theory of deferred action to argue that new purpose of use could be considered as a deferred action. Such an action cannot be entirely planned because *“human behavior and the functions of IS need to be modified in response to emergence”* (Patel 2012, p. 167). Thus, deferred action puts planned action and emergent situations in an interwoven state to provide a powerful concept that explains the new purpose of use (Patel and Hackney 2010). IS are first designed for purposive uses, but also could be opened for deferred or unanticipated actions of users. *“Deferred action, [therefore], takes place within planned action in response to emergent locale”* (Patel et al. 2010, p. 528) and, as such, specifying emergent use as a predictable variable becomes problematic (Wang and Hsieh 2006).

Similar to Patel and colleagues’ concept of deferred action, the notion of under-design (Fischer and Giaccardi 2006; Fischer and Herrmann 2011) is another concept that could enable new purpose of use. Under-design positions software designers as constructing loosely socio-technical structures of IS. They do this by embedding real-world situations half-way, waiting to be completed by users in line with their context-of-use (Fischer and Herrmann 2011). Considering users as co-designers compels system designers to design for new purpose of use and provides another way of interpreting emergent usage (Fischer and Giaccardi 2006; Germonprez et al. 2011). Scholars have articulated their thoughts around users being seen as co-designers for achieving systems’ emergent usage in the form of end-user development. This is discussed in the next section.

3.2.2 Theme 2: End-user Development (EUD)

End-user development (EUD) offers *“lightweight, use-time support which allows end-users to configure, adapt and evolve software themselves”* and create emergent uses (Fischer 2010a; Pipek et al. 2009, p. 5). As organizations, work practices, and individual task accomplishments change, the IS structure has to permit and even

support such changes (Fischer 2010a). EUD is an activity that came to prominence in the early 1980s (Amoroso 1988; Brancheau and Brown 1993; Zmud 1984). Its sustainability is due *“to the proliferation of microcomputers, increased [individual]/organizational computing needs, more user . . . development tools”* (Shayo et al. 2002, p. 135). With graphical user interfaces and *“higher computer and information literacy among . . . [individual users or] professional workers”*, EUD is also sustained (Haines et al. 2010; Shayo et al. 2002, p. 135). While retaining its originality with some variation, EUD has other similar concepts such as end-user computing (EUC), end-user programming (EUP) and end-user software engineering (EUSE) (Amoroso 1988; Burnett and Scaffidi 2014; Fischer 2010a; Ko et al. 2011; Shayo et al. 2002). These different concepts are related but each of the concepts emphasizes different research directions and challenges (Fischer 2010a).

EUC *“is defined as the optional development of computer [application] and models by personnel outside [IT] department”* (Shayo et al. 2002, p. 135) of an organization. EUC is carried out by users in order to support organizational tasks and gain the control of their own application and computing needs (Amoroso 1988; Amoroso and Cheney 1992; Brancheau and Brown 1993). EUP captures a type of software *“programming to achieve the result of a program primarily for personal, rather [than for] public use”*; such programming is unforeseen by the original designers (Ko et al. 2011, p. 4). The important distinguishable feature of EUP is that the software program designed by the end-user is primarily meant to achieve idiosyncratic, contingent, and varying needs of the user (Burnett and Scaffidi 2014; Ko et al. 2011). Examples of EUP are email users, writing e-mail rules to manage, sort and filter e-mail, and managers generating data-base backed reports with crystal reports (Ko et al. 2011). EUSE emphasizes the quality of the software that end-users create, modify, or extend and it overlaps with end-user programming (EUP) (Ko et al. 2011).

Due to significant changes in the available technology in the business environment, the concept of EUD varies with shared meanings despite inevitable nuances and alternative differences between them (Barker 2007; Fischer 2010a). Therefore, focus is on the EUD that is primarily pioneered by Fischer and colleagues from the HCI discipline, due to its anchor on emergent usage of evolutionary software artifacts that have open platforms. Such EUD is conceptualized by drawing from meta-design

theory, which these researchers also developed (Fischer 2010a; Fischer and Giaccardi 2006; Fischer et al. 2004b). It allows the practice of users creating and modifying software application for personal/organizational use, while the original designers build on such practices to extend the software's functionalities as the activities for fostering its evolutionary growth (Burnett and Scaffidi 2014; Fischer 2010a; Ko et al. 2011). Such EUD overlaps with EUP to position end-users as prosumers (Tapscott and Williams 2006) who are relatively skilled in the technologies they use. End-users exercise varying degrees of techno-sophistry to hack, modify, and evolve IT artifacts to their own requirements, on the basis of what is important for them (Fischer 2010a). They learn and discover in the technology while-in-use. They also engage in exploring, experimenting, framing, tinkering, reflecting, and solving particularized issues on the software artifacts they use, with a view to repurpose them.

To some extent the end-users are called professional amateurs in software development (Fischer 2010a; Paternò 2013); they are innovative, committed, and are a new social hybrid of human beings. Such *"human beings often act for material rewards"* in the technology's ecosystem, or in some cases *"motivated by social capital, reputation, connectedness, and the enjoyment derived from giving things of value away"* (Fischer 2010a, p. 170). An emphasis on open systems is cultivated and such systems are focused on accommodating ongoing change while-in-use *"as a desirable rather than a to-be-avoided attribute"* (Fischer 2010a, p. 171). The EUD captures the prosumers' activities in software parameterization, customization, component configuration, and programming, not minding the fact they are not in the same design space with the original designer (Fischer and Giaccardi 2006; Fischer et al. 2004b). Consequently, EUD could be used to achieve emergent usage of IS that spans from simple annotation to direct manipulation of the deep structures of the technology by users to achieve their needs, while ensuring the evolutionary growth of the system (Lieberman et al. 2006). At its extreme, it involves domain experts in the field of science or business taking a piece of software and entirely re-programming or tailoring it from the ground up to meet situated needs of the business that are emerging (Fischer 2010a; Fischer et al. 2004b).

Lieberman et al. (2006) define this kind of EUD *“as a set of methods, techniques, and tools that allow users of software systems, who are acting as non-professional software developers, at some point to create, modify, or extend a software artifact”* (p.2). Thus, EUD calls for deeper understanding and sophisticated methods for studying situated development of IS by users. Adopting EUD is aimed at: (1) *“empowering end-users to develop and adapt systems themselves”* (Lieberman et al. 2006, p. 1), (2) increasing satisfaction with end-user as technologies meet their situated and contingency needs, (3) improving end-users’ knowledge-base in the technology (Burnett and Scaffidi 2014; Ko et al. 2011; Paternò 2013). An important motivation of EUD is that end-users are implicitly co-designers where design as a process is tightly coupled to use and it continues till the end-of-life of the system (Fischer et al. 2004b).

When adopted in specific environments (such as the adaptive IS for e-financial services), EUD allows the content of the software artifact to be subjected to computational interpretation by the end-users. At the same time designers surreptitiously create deep structures of the software to accommodate, facilitate, and endorse such interpretations and place them in the individual user space. Consequently, EUD imposes an increasing learning burden depending on the level of modification; however, it is worth it because it improves the value derived from a complex system by the adopting individuals or firms (Fischer et al. 2004b).

User motivation of: being empowered, flexibility, and local control of job environment are attributes that seem to foster EUD (Fischer et al. 2004b; Paternò 2013). Other attributes are communicative empowerment of users in error resolution with the original designers (Fischer et al. 2004b), training support, and endowed expertise in the technology (Asand and Mørch 2006). Issues of context and IT governance can arise to constrain EUD. Contexts here are critical domains of environmental uncertainties for which users are forbidden to modify the system as designed (Asand and Mørch 2006). Management issues arise over power to control the system, security to limit exposure to hacking attacks, and the undue overstretch of the structures of the system (Fischer et al. 2004b; Paternò 2013).

Because of the emergence of Web 2.0 that supports collaborative activities, the EUD focus has shifted to providing cooperative knowledge exchange as socially-situated activities (Ahmadi et al. 2008; Fischer 2007). This affords the users the opportunity to focus on existing work practice, requiring systems to be tailored to suit each user's personal needs and work put together. Such a shift is behind the theory of meta-design which allows design and learning to become an everyday working practice to craft "*new media and environments that allow 'owners of problems' (i.e., end-users) to act as designers*" while-in-use (Fischer and Giaccardi 2006; Fischer and Herrmann 2011, p. 7).

3.2.3 Theme 3: Bricolage and Improvisation

Users' requirements cannot be completely established at a system's design phase because they evolve over time. Bricolage and improvisation are, therefore, considered as acts to achieve emergent IS usage to fulfill unforeseen task specifications as framed by the users (Ciborra 1992, 1996; Heeks 2002; Magni et al. 2010). Besides, *a priori* establishment of all-encompassing user requirement changes is unfeasible when implementing IS (Orlikowski and Hoffman 1997; Orlikowski 1996). Therefore, users engage in the act of bricolage and improvisation to adapt the new technology to their needs in the post-adoption phase. Following Magni et al. (2010) who draw from theoretical frameworks of creativity and spontaneity (Vera and Crossan 2005), the researcher defines "*individual improvisation as the creative and spontaneous process of trying to achieve an emergent need in a new way*" in IS (p.246). Magni et al. (2010) argue that improvisation subsumes the act of bricolage which captures the creativity aspect of improvisation. Bricolage is the "*creative process in which individuals engage in the attempt to find a new solution from the recombination of available resources in a short time-frame*" (Magni et al. 2010, p. 246). When this short time-frame becomes spontaneous, that act of creativity is improvisation rather than bricolage. Improvisation is, therefore, a provocative creative process since it challenges the linear thinking of expert minds. In workplace systems (Alter 2014), the spontaneous manner attached to improvisation does not necessarily mean that decisions may not be considered in advance, since organizations have rules and norms that enable

people to depart from routines to create new variations (Arora et al. 2010; Orlikowski and Hoffman 1997).

Bricolage is emergent in that the bricoleur continuously re-uses, recombines, and re-appropriates IT resources to create a new context for new processes. At the bricolage stage, users engage more of their technological cognizance (Nambisan et al. 1999) because it demands more of thinking (Ciborra 1996; Tjørnehøj and Mathiassen 2010). A bricoleur uses IS resources with which they are familiar to address new tasks and challenges (Teoh and Wickramasinghe 2011). Thus, bricolage implies a situated creativity and the ability to cope with limited resources to explore between problem space and solution space (Molnar and Nandhakumar 2008).

Both bricolage and improvisation are iterative, situational, and temporal processes that emphasize the embodiment of socio-economic and cultural contexts into IS structures (Teoh and Wickramasinghe 2011). Therefore, bricolage and improvisation are acts of technology-use considered as embodied interaction within an emergent locale (Ciborra 2002; Dourish 2001). Both creativity and expertise are needed to be able to react flexibly and effectively outside the traditional method, for bricolage or improvisation to reveal new uses (Arora et al. 2010; Ciborra 1999, 2002).

Bricolage and improvisation can be individually situated or they can be group activities in a collaborative workplace system (Arora et al. 2010; Orlikowski and Hoffman 1997). As a group activity coordination, collaboration, and communication are institutionalized as a means of fostering the continuous flow of information, ideas, and management of existing resources (Arora et al. 2010; Hayes 2000). Improvisations are utilized in organizational adoption of software process improvement (SPI) (Tjørnehøj and Mathiassen 2010). Organizations can utilize improvisation to enhance employees' creativity, motivation, and empowerment in IS adaptation, despite constrained resources (Tjørnehøj and Mathiassen 2010). Improvisation as a mode of IS usage is promoted in workplace systems, leading to more creative use, but it can result in drift, unanticipated consequences, and rejection (Ciborra 2004; Ciborra and Willcocks 2006).

Closely associated with bricolage and improvisation are workarounds (Alter 2014; Hovorka and Germonprez 2013). Workarounds in adaptive IS could be triggered by experiences of misfits, exceptions, and anomalies (Alter 2014; le Roux 2014), system deficiencies, and structural constraints (Alter 2014; Boudreau and Robey 2005). Other factors fostering workarounds include organizational readiness and practices within work systems (Alter 2014) and employees' ability to execute a workaround (Alter 2014).

3.2.4 Theme 4: Appropriation

There is no one way of achieving emergent usage of IS innovations (Stocker et al. 2012). The true potential of IS innovations only manifests when users make sense of and incorporate them in their everyday life (Riemer et al. 2009; Yoo 2010). Appropriation is one example of emergent usage activity (DeSanctis and Poole 1994). *“Appropriation has been a central concept in the social constructivist [paradigm] of IS”* with two contentious views (Delaney et al. 2008, p. 1; Stocker et al. 2012). One view holds that emergent usage of IS is based on embodied interactions (DeSanctis and Poole 1994; Leonardi and Barley 2010; Orlikowski 1992); the other opposing view holds that such emergent interactions are enacted by humans, and the embodied structures of IS have no causal role (Delaney et al. 2008; Orlikowski 2000; 2005). Notably both views examine the relationships between technology, human agency, and social structures. Even though this is an ongoing debate that the research intends not to adjudicate, the researcher argues in favor of appropriation as embodied interactions, as it resonates with the underpinning critical realist stance adopted in this study (Leonardi and Barley 2008; Mutch 2013).

Appropriation thrives when humans realize that essential powers are fulfilled by objects in nature. While the object in this study is an IS, enactment of humans *“cannot operate in isolation of the object, for all perception requires both the senses and the object being sensed”* (Delaney et al. 2008, p. 10). The existence and advancement of IS are dependent on the ability of humans to manipulate, create, and recreate the material agency of IS as the object operating in a certain environment (Al Lily 2013; Leonardi 2011; Robey et al. 2012). In this sense, humans are better seen as non-cultural dopes (Archer 1995) in the sense that they, whether impulsively

or with intent, shape the material agency of such objects they experience for their own advantage. Thus, it is appropriate to follow Dourish's (2003) definition of appropriation as:

the way in which technologies are adopted, adapted and incorporated into working [or task] practices. This might involve customization in the traditional sense (that is, the explicit reconfiguration of the technology in order to suit local needs), but it might also simply involve making use of the technology for purposes beyond those for which it was originally designed, or to serve new ends (Dourish 2003, p.467).

Dourish's (2003) view of appropriation presupposes that IS has embedded structures that users can adapt or which can adapt themselves, to circumvent the causal power of the embedded structures (Boulus and Bjorn 2010). Thus, technology use cannot only differ from design intent, but also can change over time. Practices and structures can change in response to technology and the way it is used (Boulus and Bjorn 2010; Dourish 2001).

Adaptive structuration theory (AST) is a theoretical work put forward by DeSanctis and Poole (1994) that can arguably be said to have introduced the notion of appropriation to the IS discipline. The AST approach is derived from Giddens' structuration theory (Giddens 1984; Jones and Karsten 2008). It considers technology as embodying structures (rules, resources, and capabilities offered by the system) and the spirit (the intended use of the technology). By engaging an organizational groupware system, AST posits that IS embodied structures act as mediators of change. Integrating such a technology into practices can be appropriated *faithfully or unfaithfully* depending on whether the integration is in conformity with the spirit. Empirically, the notion of faithful appropriation by AST has been seen to ensure optimal use of IS in organizations (e.g., Ruel 2002).

Similar to AST, Orlikowski (1992) draws from Giddens to focus on the role of technology in structuration. Orlikowski's (1992) attempts, while holding on to embodiments of structures in IS, highlight the beneficial effects of both *faithful and unfaithful* appropriation. Thus, appropriation can be considered as a technology-related form of structuration brought about by the causal efficacy of the embodied

structures, its negotiation, and the interpretive flexibility of humans (Majchrzak et al. 2000; Orlikowski 1996; Rodon et al. 2011). Based on this, all appropriation can be taken as positive renewals of the IT structures and organizational structures. Such structures are seen as routines or rules and could extend to socio-cultural structures in embedded contexts (Dey et al. 2011; Lindtner et al. 2012; Rodon et al. 2011). Early works of Orlikowski (1992) as well as DeSanctis and Poole (1994) have synonymized appropriation with organizational group activities, but technology can be appropriated as well at individual level (Bar et al. 2007; Carroll et al. 2003).

To introduce appropriation of IT at individual level, Bar et al. (2007) tackle the conflict relationship existing between socio-economic conditions and mobile phone designated use. They do that through the effective combination of AST (DeSanctis and Poole 1994) and cultural appropriation (Jamison and Hard 2003) to introduce the cannibalistic appropriation model. De Souza e Silva et al. (2011) engage with this latter model to investigate the illegal cloning of mobile phones that takes place in cyclic power relations between low-income enclaves inside urban spaces in Brazil. Although Bar et al.'s (2007) model does not give room for dis-appropriation, Carroll et al. (2002, 2003) formulate the model of technology appropriation (MTA) that incorporates and recognizes that dis-appropriation can also occur.

The MTA model typifies appropriation as a process of transforming technology-as-designed into technology-in-use. *“Technology-as-designed embodies the designers’ intent”* while technology-in-use captures users’ expression through action (Carroll et al. 2003; Delaney et al. 2008, p. 16). Carroll (2004) later extends the model to include an appropriation cycle embedded with users’ evaluation tendencies. Thus, designers first construct the technology, while users close the design cycle in their context-of-use (Delaney et al. 2008). The MTA process cycle has three phases; (1) encountering the technology, (2) adopting and adapting of technology, and (3) *“stabilizing it by integrating it into [task] routines and practices”* (Delaney et al. 2008, p. 16). Phase 1 of MTA begins with a user evaluating the technology as designed, while in Phase 2 the user engages the filtering process to retain certain attractors that encourage appropriation (Carroll 2004; Carroll et al. 2002). Thus, the user personalizes or reconfigures the technologies with the intention of exploring further its features for innovative use, bearing in mind its constraints. Lack of

attractors could warrant non-appropriation at this stage. At the last phase – where appropriation is reached – the technology is stabilized with self-discovered reinforcers *“that fortify the technology as part of [the user’s] activities”* (Delaney et al. 2008, p. 17). This could lead to further re-evaluation or the possibility of dis-appropriation of the technology (Carroll 2004). Thus, MTA provides a rich *“understanding of the process of appropriation through which technology is evaluated by people over time and adopted, adapted, and incorporated into their practices”* (Fidock and Carroll 2011, p. 33). MTA is drawn upon in the context of mobile telephony interaction for Bangladeshi farmers (Dey et al. 2011). The study focuses on understanding how the farmers appropriate the technology and negotiate through the difficulties associated with the technology’s interactions. Appropriation is seen to be reinforced by social, occupational, and psychological structures, while financial constraints, lack of interest, non-expertise, and inclination to follow the designer intent are motivators of dis-appropriation (Dey et al. 2011).

Despite the relevance of MTA, its critique focuses on its insufficient power to explain how and why technology changes or stabilizes over time (Fidock and Carroll 2011; Rahim et al. 2010). Other critiques of MTA emanate from non-consideration of socio-cultural factors that could influence people’s appropriation of technology in their context-of-use (Jones and Issroff 2007). Consequently, Fidock and Carroll (2011) refine the model by juxtaposing the teleological, dialectic, and evolutionary lens of Van de Ven and Poole (2005) on MTA. Despite the excellent work of Fidock and Carroll (2011) in shifting the MTA from its original static view to the dynamic view, the model still dwells on how users appropriate mobile technologies and not on why (Jones and Issroff 2007). Like MTA (Carroll 2004; Carroll et al. 2002), by drawing from activity theory, Waycott et al. (2005) develop a process model of how mobile technology is appropriated by learners. Waycott et al.’s (2005) model is helpful in understanding the socio-cultural factors earlier ignored by MTA. Also, Fuller and Dennis (2009) draw from the fit appropriation model (FAM) (Dennis et al. 2001) to confirm that system-task misfit triggers systems’ appropriation, seen to foster team performance in a collaborative technology.

Appropriation, so far discussed, focuses on users’ actions and socio-technical structures that stem from socio-cultural perspectives. Salovaara (2008) and

Salovaara et al. (2011) take a different turn by focusing on the cognitive processes influencing appropriation. Appropriation from this perspective anchors on users perceiving technology as a tool for action, thus acquiring a new mental usage schema for repurposing technology on the basis of its existing features (Salovaara et al. 2011).

Generally, IS appropriation research has focused more on the organization level and less on the individual level. By drawing on activity theory, Wiredu (2007) focuses on the duality of personal and organizational appropriation of mobile technologies. Wiredu's (2007) study is interesting because it shows how the appropriation of mobile technologies among nurses could drift from organizations' intent to meet personal relevance, which also complements organizational practices. Such unforeseen usages are triggered by factors such as motives-in-use, conditions-of-use, and technology design properties (Wiredu 2007). These factors are made clearer during the technology's use to showcase the dissolution of the organization-private usage gap between work and private life.

3.2.5 Theme 5: Adaptation

Much of this review so far has emphasized emergent usage that stems from unintended use or situated improvisation and appropriation. However, other forms of novel use exist wherein the user intentionally tweaks the features of a system, aligning them closely to his or her needs. Users can also adjust their behavior to fit with a system's features through self-adaptation (Boulus and Bjorn 2010; Park and Chen 2012). Adaptation is defined as a process that users engage with in modifying technology, or relevant aspects of its operating context such as the features or contents, and including users' skills, cognitions, or work procedures (Barki et al. 2007; Sun 2012; Tyre and Orlikowski 1994). Certain studies have focused on the adaptation of user behaviors (Boudreau and Robey 2005; Boulus and Bjorn 2010; Convertino et al. 2007), whereas others have studied how technologies are modified, tweaked, or 'worked around' by users (Ahuja and Thatcher 2005; Desouza et al. 2007; Jaspersen et al. 2005; Mills and Chin 2007; Rice and Rogers 1980; Saga and Zmud 1994; Schmitz et al. 2010; Singletary et al. 2002; Sun 2012; Tyre and Orlikowski 1994).

Most adaptations manifest as deviations from designers' intents, as users modify and repurpose systems' features in new and innovative ways (Salovaara et al. 2011; Sun 2012). Similar to bricolage, the early work of Rice and Rogers (1980) unveils the fact that users can selectively 'mix and match' various components of the system to locally design suitable versions of the innovation. Boudreau and Robey (2005) reveal users' prowess in reinventing themselves to compensate for a system's deficiencies. By repurposing the systems via adaptation, users not only discover new and novel uses, but also new ways of implementing the system (Jasperson et al. 2005). Such usage behaviors abound in systems and are labelled as creative use (Mills and Chin 2007), unanticipated uses (Singletary et al. 2002), trying to innovate (Ahuja and Thatcher 2005), feature extensions (Jasperson et al. 2005), emergent use (Saga and Zmud 1994; Wang and Hsieh 2006), adaptive system use (Sun 2012), transformative use (Straub and del Giudice 2012), or IT adaptation (Beaudry and Pinsonneault 2005; Bhattacharjee and Harris 2009; Schmitz et al. 2010). Nan (2011) draws from CAS theory to conceptualize adaptive system use as a bottom-up or emergence type of IT use. By arguing that adaptation is synonymous with emergent IT use, Nan (2011) descriptively positions mechanisms of agents, interaction, and the environment as antecedents of emergent IT use.

By drawing from theory of trying (Bagozzi and Warshaw 1990), users' work overload and autonomy are empirically validated to be antecedents of trying to innovate with technology during post-adoption (Ahuja and Thatcher 2005). The interactions between overload and autonomy are moderated by gender to also influence trying to innovate (Ahuja and Thatcher 2005). By grounding their study in Bandura's (1986) self-efficacy theory, Mills and Chin (2007) confirm that users' knowledge and skills, as well as self-efficacy, influence creative use. Technology can be adapted either in an exploitive or exploratory manner (Schmitz et al. 2010). Exploitive adaptation is where users change to an IS align with anticipated and intended functions of the technology. Exploratory adaptation captures users' innovativeness or changes that are outside the designers' intent (Schmitz et al. 2010). Exploitative and explorative strategies are confirmed to influence IS adaptation (Bhattacharjee and Harris 2009; Schmitz et al. 2010).

By drawing from coping theory (Lazarus and Folkman 1984), Beaudry and Pinsonneault (2005) consider adaptation as emergent, in order to cope with the perceived consequences of the technological event. Such an event is considered as novel and can constitute a disruption in organizations. Thus, users' adaptation is explained by the coping model of usage adaptation (CMUA). Motivators of such adaptation are benefits satisficing, benefits maximization, disturbance handling, and self-preservation. Similarly, Sun (2012) reveals that three factors influence adaptive system use: (1) novel situations, (2) discrepancies in interaction with the computer, and (3) deliberate initiatives to learn new uses. While some of these motivators target emergent IS usage, they have the potential of impacting on individual task/organization performance (Fuller and Dennis 2009).

Self-adaptation based on cognitive and behavioral efforts exists in mobile technologies or workplace systems (Barki et al. 2007; Beaudry and Pinsonneault 2005; Fadel 2012). Such behaviors can be targeted at the user, the technology, and the task, to further confront IS underutilization (Boulus and Bjorn 2010; Fadel 2012). By drawing from Schön (1983), Boulus and Bjorn (2010) argue that self-adaptation such as reflection-on-action can foster technology-in-use practices that are novel. Reflection-on-action is a process whereby users renegotiate technology-in-use by constantly re-aligning technology and their situated actions (Boulus and Bjorn 2010). Other self-adaptation behaviors that users engage with in achieving new tasks they previously had not attempted are: tinkering and learning new skills (Barki et al. 2007; Hovorka and Germonprez 2011; Tyre and Orlikowski 1994), adjusting personal habits to fit technology's requirements (Orlikowski 1996; Tyre and Orlikowski 1994), adjusting work commitments (Davidson and Chismar 2007; Tyre and Orlikowski 1996), and modifying work/task routines and procedures (Davis and Hufnagel 2007; Schmitz et al. 2010). Modification of work/task routines is similar to what other IS scholars label as adapting the work/task (e.g., Barki et al. 2007; Beaudry and Pinsonneault 2005).

3.2.6 Theme 6: Customization and Tailoring

Customization and tailoring are other activities users engage with in creating usages that are new in the IS environment (Desouza et al. 2007; Germonprez et al. 2007).

Customization is used interchangeably with user-initiated personalization (Sundar and Marathe 2010), although system-initiated personalization has been ever-present in adaptive systems (Germonprez and Collopy 2004; Marathe and Sundar 2011). Users might not be fully satisfied with the offerings that system-initiated personalization provide and may decide to change some things to further identify them (Kwon and Kim 2011; Sunikka and Bragge 2012). Thus, customization occurs when users themselves modify some aspect of an interface to a certain degree, or parameterize adaptive system functions so as to increase their personal relevance (Fan and Poole 2006; Lieberman et al. 2006). Customization is of two types: appearance-based and functional-based customization (Marathe 2009). Appearance-based customization is carried out by users to establish an emotional connection and communicate self-identity (Marathe 2009; Mugge et al. 2009; Tossell et al. 2012), for instance, customizing a mobile phone by enclosing it in a diamond encrusted case. Such customization is most times underpinned by socio-cultural structures and situated behaviors. Functional-based customization allows users to make functional changes in the deep structures of the technology. While such customization allows users to achieve utilitarian value, social media provides an additional step for users to create emergent usage by tagging, commenting, tweeting, or blogging information, to serve as a source for others to satisfy social and emotional needs (Germonprez et al. 2011; Sundar et al. 2012). The phenomenal growth of blogging or tweeting serves as a testimony to the powerful appeal emergent usage holds among users themselves, being facilitated by social media technologies (Sundar et al. 2012). Unlike system-initiated personalization that has recorded much historicity in the IS field (Monk and Blom 2007; Sunikka and Bragge 2012), customization is a highly user-driven process of tailoring content for achieving emergent use of systems. There have been few studies around this phenomenon (Germonprez et al. 2011; Monk and Blom 2007; Tossell et al. 2012). Users engage in the act of customization to tailor e-service delivery systems and create value (Mathwick et al. 2010). Given that this study examines e-financial service delivery, the focus is on customization rather than system-initiated personalization (Mathwick et al. 2010).

Users are attracted to customization because it enhances their sense of agency, autonomy, and freedom (Oulasvirta and Blom 2007; Sundar and Marathe 2010; Tossell et al. 2012). It also offers predictable decision-making processes (Marathe

and Sundar 2011), allows users to exert control over a system's functionality, and initiates actions on their own (Mathwick et al. 2010; Sundar and Marathe 2010). Other motivators of users' customization are innovativeness and aesthetic appreciation (Mathwick et al. 2010; Tossell et al. 2012).

Using a grounded theory approach, Blom and Monk (2003) formulate the theory of user-initiated personalization of appearance. This theory is then validated in Monk and Blom (2007) in the context of a university website. Frequent use of systems, knowledge of personalization, and socio-emotional context-of-use are factors confirmed to influence user-initiated personalization (Monk and Blom 2007). User-initiated personalization has obvious advantages, one of which is the reduction of cognitive overload (Guida et al. 2009). Such reductions enhance the capacity of humans to store information reliably and rapidly in long-term memory (Guida et al. 2009).

To further deepen the degree of customization, users undergo the act of tailoring to create new and unanticipated uses (Germonprez and Collopy 2004). Tailoring is a process that involves task accomplishment based on pre-assessment of key individual differences. It overcomes the cognitive and normative barriers designers put in place in technologies and allows users *"to see, appreciate and utilize all the potential"* features the technology holds (Germonprez et al. 2009, p. 15). By reflecting *"on the situated tasks and on the resources embedded in the technology"* (Germonprez et al. 2009, p. 15), users engage in tailoring activities to create new and innovative ways (Germonprez and Collopy 2004). Tinkering with the system features without a specific task in mind is considered an ad hoc way of tailoring the system (Ciborra 2002; Hovorka and Germonprez 2011). Such an act triggers system functionalities to create meaningful uses which can be consolidated as new configurations emerge over time (Germonprez et al. 2011). The affordances provided by the system empower the user to act as a designer by tinkering and tailoring the system (Hovorka and Germonprez 2011). Such empowerment is noticed as users rearrange or modify the icons on their user interfaces, or do complex tailoring by using widgets to define the software contents (Hovorka and Germonprez 2011). Over time, tailoring becomes users' everyday work; it makes them experience the technology as under their control when creating novel uses. At this point, tailorability

becomes a relationship rather than a property of technology, wherein it addresses how technology fits into users' task accomplishments and how the users make use of the technology to create emergent uses (Germonprez et al. 2011).

3.2.7 Theme 7: Making the System One's Own

Integration of a new technology into one's routines and practices makes one feel more personal self-realization of one's identity. Such an integration can also create new uses and innovations (Carroll et al. 2001; Marathe and Sundar 2011). This view is mostly associated with IS studies that engage social constructivist theories such as social shaping of technology, or its subsets such as domestication theory (Harwood 2011; Hynes and Richardson 2009; Silverstone et al. 1992). Emergent usage of technology is accomplished by a domestication process that shows how technology becomes embedded within a local context-of-use (Harwood 2011; Silverstone et al. 1992).

Originally, domestication, which “*evokes a sense of taming the wild*” reflects the process of socio-cultural appropriation of technologies in the context of the family home (Haddon 2011; Silverstone et al. 1992). It focuses on the nexus of technology's functions that relates to the new purpose of use, and on symbolic processes that are related to the meanings ascribed to technologies by users in their everyday life (Hynes and Richardson 2009). Meanings here are not static, but are similar to the reflection-on-action concept (Boulus and Bjorn 2010). Therefore, users undergo a renegotiation experience in a continuous fashion to situate the domesticating of technology as emergent. Early work on domestication (e.g., Silverstone et al. 1992) addressed media consumption in household domestic settings, particularly television use, where use was not based on the deterministic notion, but by emergence (Berker et al. 2006; Harwood 2011).

Silverstone et al.'s (1992) version of domestication is also adopted by scholars (e.g., Harwood 2011) to cater for non-household technologies such as online hotel booking. Other scholars (e.g., Lie and Sørensen 1996; Sørensen 2006; Sørensen et al. 2000) draw from social shaping theory or actor-network theory (ANT) to conceptualize technological domestication outside the household. For Lie and Sørensen (1996),

Sørensen (2006), as well as Sørensen (2000), domestication is seen as a co-production of social and technical properties made clearer during use. It could be triggered by social learning, or an act users deploy to make technologies work by repurposing it (Sørensen 2006).

Similarly, by drawing from social shaping theory, Al Lily (2013) demonstrates how socio-cultural relations that are held sacrosanct are embedded to shape educational technologies in a Saudi Arabian university. Thus, the pre-existing social relations enable the shaping or customization of technologies, which in turn are used to reinforce the values of such social relations. In doing that, the reconfigured technologies are then used in an emergent way by a group of users accessing technology on the basis of gender differences (Al Lily 2013).

Another viewpoint on ‘making a system one’s own’ comes from activity theory, which looks at emergent usage as technology-mediated activities (Allen et al. 2013; Barki et al. 2007). Technology is seen as a tool users engage in within the activity ecosystem; the technology is transformed while-in-use as it mediates users’ interactions with the objects of their actions (Allen et al. 2011). By drawing from task-technology fit (TTF) theory (Goodhue and Thompson 1995) and activity theory (Engeström 1987), Barki et al. (2007) conceptualize emergent usage of IS as “*IS use-related activity (ISURA)*” (p.174). ISURA “*is viewed as encompassing not only a person’s interactions with the IT in accomplishing tasks, but also a person’s activities that adapt, change, or modify any element of the task-technology individual context*” (Barki et al. 2007, p.174). Technology interactions, individual adaptation, and task-technology adaptation are factors considered to influence IS use-related activity (Barki et al. 2007). By so doing, the technology gradually finds its place in the individual repertoire of actions to fit into different situations in which users might use the technology.

Having discussed the various perspectives of achieving emergent usage of IS innovations, the next section is focused on experiential characteristics of IS to provide further scoping of the study.

3.3 Emergent Usage Experience (UX) of IS

This section explores the components that describe emergent user/usage experience (UX) of technologies due to its actual usage. This is done through a review of relevant literature on UX, aimed at synthesizing a framework of concepts relevant to the research context. Experience, defined as personal knowledge or skill derived in reaction to stimuli such as participation or observation, is a broad concept (Bassi 2010; Yoon 2010). Therefore, experience is limited to the one in relation to user-system interactions as an ongoing reflection on events of which we are part. As Forlizzi and Battarbee (2004, p. 263) would say: “*a constant stream of self-talk when we interact*” with a technology. Events in this sense are incidents of emergent behavior that are experiential, emotional, and utilitarian, and are distinct enough to capture meaningful changes that occur because of user-system interactions (Germonprez et al. 2011; O’Brien 2011). Such events contain cues that are critical for recognition of an action in the technology’s ecosystem (O’Brien 2011). As an ongoing reflection, UX stretches over time, with a temporal dimension because it will end; throughout the event, the user critiques him/herself to ascertain how good or bad the experience was (Hassenzahl 2008; O’Brien 2011; Roto et al. 2011).

While interaction is the observable behavior of the user, user experience provides the link to establish a series of causally connected interactions; this includes retrospective experience of past interactions (i.e., apperceptions) that effectuate the actual interactions, and prospective experiences about future interactions (Al-Natour and Benbasat 2009; Pohlmeier et al. 2009; Saariluoma 2003). To understand emergent IS usage, one needs to understand the components that characterize such interaction-experience linkages in systems that are interactive. Besides, individuals often appropriate structures of such systems based on prior experiences which could constrain or enable their perceptions and behavior repertoire, which also changes over time (Fuller and Dennis 2009; Law and Abrahão 2014). Taking IS use as UX allows us to regard IS use as social positions that exist because of user-system relations (Mutch 2010b). Such relations warrant planned and emergent duality of use that positions IS use as a dynamic process and outcome of situated actions of human experiences, not necessarily by intentions (Germonprez et al. 2011; Oja and Galliers 2011).

Studies differ in the perspectives through which interaction/interactivity is viewed (Mollen and Wilson 2010). Nevertheless, interaction here is viewed as the “*the extent to which users can participate in modifying the form and content of the mediated environment in real time*” (Mollen and Wilson 2010, p. 920), taking account the cognitive processing, the embedded structures of IT, the context, and the engagement with the activity (Dourish 2001, 2004; O'Brien and Toms 2008). The engagement element of the interaction captures to some extent the experiential and the emotional aspect of the interaction (O'Brien and Toms 2008, 2010). Interaction with the technology is through a user interface which is a goal-oriented activity (Springett and French 2007; Xiao and Benbasat 2007). Thus, the user interface represents action potentials not just for the task's environment and tools, but also for the process of interaction, i.e., the contribution made by both the user and the embodied structures of the IS in its situated context (Oja and Galliers 2011).

To identify the socio-technical mechanisms for emergent interaction of IS, users' perceptions, apperceptions, and experiences can provide a useful starting point (Mingers 2006; Saariluoma 2003; Tsang 2013). Humans have always been creative tool-users (Tomasello 1999), and emergent usage of technology is a natural part of human cognitive functioning. Research can reveal how perception, *apperceptions*, experience and situated action interact during emergent usage of technology to identify the experiential factors that characterize such use. Based on this, one can then retroduce backward and identify the underlying mechanisms that are responsible for such interactions (Easton 2010a; Mingers 2006).

Recent changes in IS towards interactive systems and the users' demand of a more ‘*out-of-the-box*’ experience has given rise to emergent UX. Following Oja and Galliers (2011), UX is argued to be emergent because it is a situated action, subjective and not a stable phenomenon, but arises due to changes in the users, the system, and the overall context-of-use and the fact that no two experiences are equal (Bassi 2010; Pohlmeier et al. 2009; Roto et al. 2011). Such changes are not passive; rather, users actively engage their interpretive flexibility in framing its meaning (Karapanos 2013; Orlikowski 1992), which, in turn, defines future intended and unintended user actions (Markus and Robey 2004; Norman 2004). Meaning here is the sense individuals make of an IT artifact, reflecting the interrelation of rationality, affect,

situatedness, and personal characteristics in describing actual system usage (Hassenzahl 2003; Knijnenburg et al. 2012; Thüring and Mahlke 2007). As observers of our own experiences, these elements cannot be separated, since they interact and modify each other, except perhaps in extreme cases to define the actual usage of IS (Goh and Karimi 2014). Thus, emergent user experience captures the initial interactions of IS to the prolonged experiences as a result of its usage, understanding how a system becomes meaningful in a person's life (Karapanos 2013; Pohlmeier et al. 2009; Roto et al. 2011).

Unlike in the IS field where UX is implicitly subsumed in acceptance-intention models and conceptualized as cognitive absorption or flow experience (Deng et al. 2010; Pallud and Straub 2014; Zhou 2012), UX in the HCI discipline is recognized as an explicit concept tied to actual usage situations and can be observed or measured (Law et al. 2014; Oja and Galliers 2011). The acceptance-intention models focus on the early phases of UX, i.e., the expected UX or, at most, UX from the initial interaction on the basis of intentionality to use and re-use the system (Pallud and Straub 2014). It *“does not recognize the possibility that [the user] can invent new uses of technology in many situations”* (Salovaara and Tamminen 2009, p. 157) such as through tinkering, bricolage, and improvisation (Ciborra 2004). By not recognizing users as inventors of new uses, the acceptance-intention models assume users as passive with the same usage orientation *“irrespective of the context-of-use, the differences in”* task accomplishments, and individualized preferences (Salovaara and Tamminen 2009, p. 157). In contrast, UX accommodates novel and re-purposeful user-system interactions to position such uses as emergent (Law et al. 2014; Oja and Galliers 2011; Salovaara and Tamminen 2009). UX begins with the anticipated interaction to the actual interaction and continues as long as the user remembers his/her interaction with the technology, which also impacts on the future re-use of the technology (Pohlmeier et al. 2009; Roto 2007; Salovaara and Tamminen 2009). Besides, acceptance or intention does not necessarily suggest actual usage (Bhattacharjee and Barfar 2011) or good UX, as in the case of mandatory systems where users are expected to interact with the technology despite poor UX (Oja and Galliers 2011). While some of the components in acceptance-intention models are relevant, UX consists of something more including the actual usage – not intentions, hedonic attributes, experiential qualities, and the situational and personal

characteristics of the user in the interaction (Knijnenburg et al. 2012; Pallud and Straub 2014; Thüring and Mahlke 2007).

There is no unified definition or a unified theory of UX when it comes to systems' usage, because of different viewpoints to the concept of UX (Deng et al. 2010; Forlizzi and Battarbee 2004; Thüring and Mahlke 2007). Following the recent ISO standard (2010), Olsson (2013, p. 204) defines UX as *"a person's perceptions and responses that result from the use or anticipated use of a product, system or service"*, although some scholars consider this definition as abstract (e.g., Law 2011). Knijnenburg et al. (2012) also define UX in the IS field as *"the users' subjective evaluation of their interaction with the system"* (p. 443). Because of its holistic and *"conceptual richness from different viewpoints, UX is often critiqued as being vague and elusive"* (Olsson 2012, p. 28). To curtail its broadness, Olsson (2013) suggests particularizing UX to an IS innovation. Thus, the research strives to cluster UX into three themes, based on how it is positioned with respect to usability in certain IS innovation, as shown in Figure 10 in the literature review. Based on the ISO 9241-11 (1998) standard, usability is defined as *"the extent to which a system can be used by specified users to achieve a specified goal with effectiveness, efficiency and satisfaction in a specified context of use"* (n. p). While interactive systems can be broad, including physical artifacts (Hassenzahl 2008; Rafaeli and Vilnai-Yavetz 2004), the focus here is on adaptive IS whose variants can be e-financial systems, which are considered in this thesis as interactive systems (Germonprez et al. 2011). These themes will now be discussed, starting with the first theme.

As Figure 10 illustrates, the literature review is conducted as it pertains to UX, based on the three themes. Table 5 is used to illustrate how the literature is analyzed in relation to Figure 10.

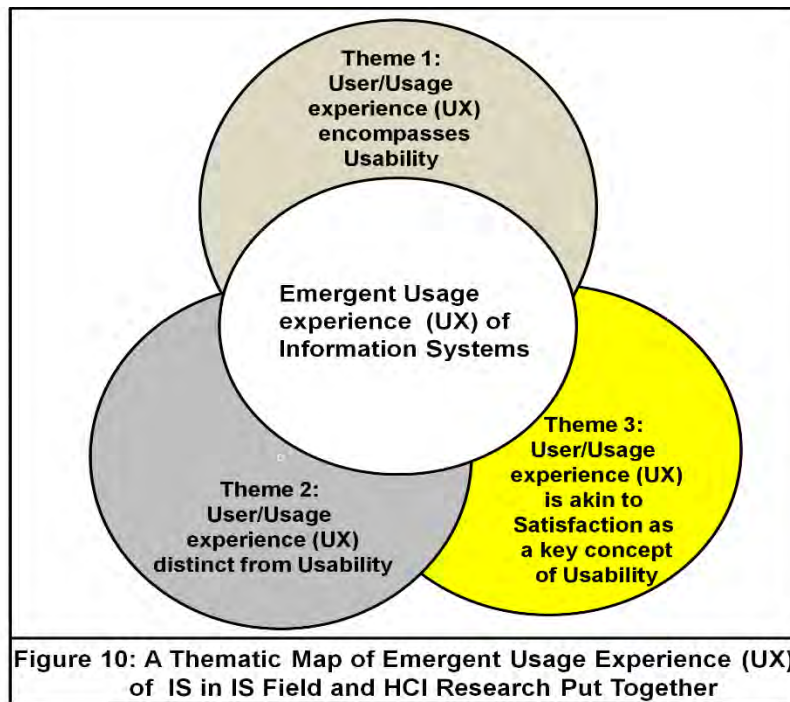
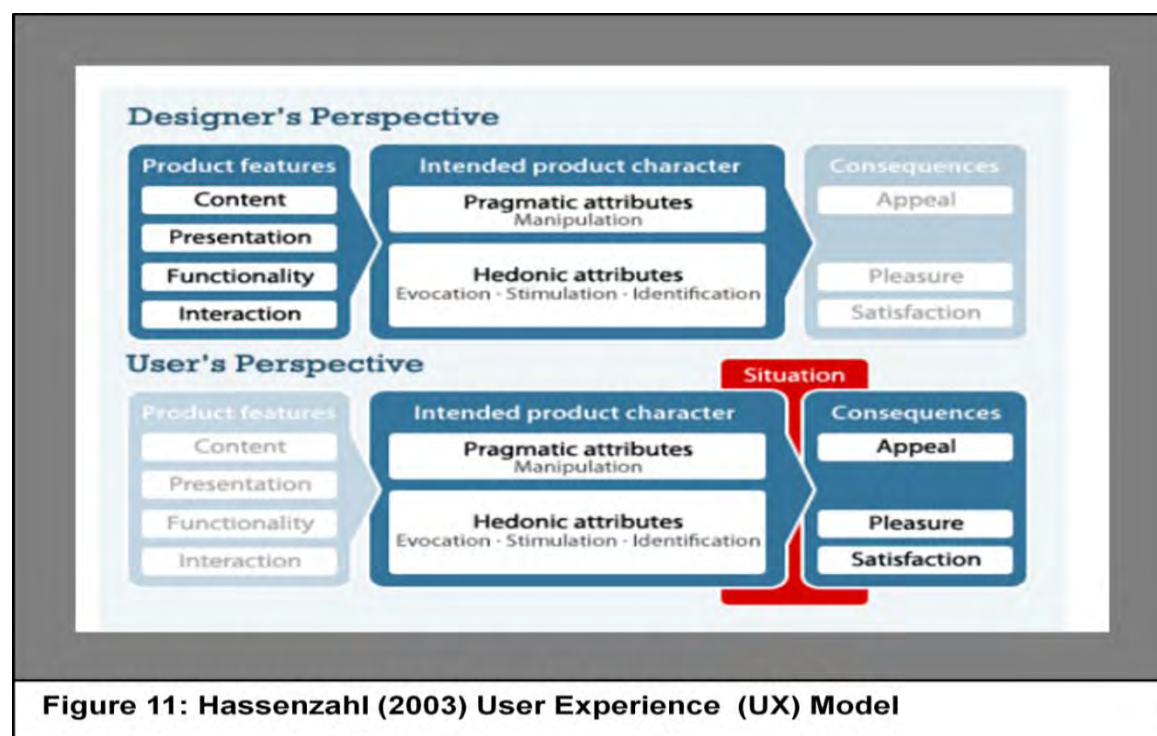


Table 5: Existing Perspectives of Emergent Usage Experience (UX) of Information Systems (IS)			
Proposed Typology or Themes	Field of Research	Example Studies	Contexts
Usage experience (UX) encompasses Usability	IS as a discipline and HCI field	(Attfield et al. 2011; Avgerou and McGrath 2005; Hassenzahl 2003; Hassenzahl and Monk 2010; Jetter and Gerken 2007; Knijnenburg et al. 2012; Law and Abrahão 2014; MacDonald and Atwood 2014; O'Brien and Toms 2010; O'Brien 2010; Olsson 2013; Pallud and Straub 2014; Park et al. 2013; Thüring and Mahlke 2007)	Information technologies including mobile and e-commerce technologies.
Usage experience (UX) distinct from Usability	IS as a discipline and HCI field	(Beaudry and Pinsonneault 2010; Hartmann et al. 2008; Hassenzahl 2008; Hassenzahl et al. 2010; Hassenzahl and Monk 2010; Kujala et al. 2011; McCarthy and Wright 2004; Rousi et al. 2010; Saariluoma et al. 2013; Saariluoma et al. 2009; Van der Heijden 2004; Wixon 2011; Wright et al. 2004)	Information technologies including mobile and e-commerce technologies.
Usage experience (UX) akin to Satisfaction	IS as a discipline and HCI field	(Mavlanova et al. 2015; Morgan-Thomas and Veloutsou 2013; Román 2010; Rose et al. 2011; Xiao and Benbasat 2011; Xiao and Tan 2012; Yoon 2010)	Information technologies including mobile and e-commerce technologies.

3.3.1 Theme 1: UX encompasses Usability

Studies have identified concepts that characterize UX of interactive systems on the basis of task-oriented goals or usability elements (Law et al. 2014). However, UX may be understood as a broad concept that encompasses usability and other elements such as affects, social, organizational, personal, and cultural factors (Olsson et al. 2013a). Some scholars in HCI hold this all-encompassing view of UX (e.g., Law and Abrahão 2014; Olsson 2013; Thüring and Mahlke 2007), as well as IS scholars in the context of e-commerce recommender systems (e.g., Knijnenburg et al. 2012). A number of frameworks have been proposed for understanding the nature and scope of UX within this domain (Kujala et al. 2011). Prominent among them are Hassenzahl's (2003) UX model, shown in Figure 11, and the components of user experience (CUE) model developed by Thüring and Mahlke (2007).



Hassenzahl (2003) develops a UX model that captures both designers' and users' perspectives. As illustrated in Figure 11, the model mirrors the inseparability of pragmatic and hedonic aspects of UX. The pragmatic aspect reflects the re-purposefulness (i.e., manipulation) of a product (in this case IS) in the hand of consumers/users to meet task-oriented goals. Such a rational interaction in turn influences affective feelings within a situated context. The affective feelings of the

past interactions trigger evocation or savoring memory; this encourages the development of interest (stimulation) in interacting with the product which sometimes is based on social acceptance (identification). The designer's perspective focuses on designing UX that affords satisfactory system functionalities with engaging and stimulating interactions in its context-of-use. Similar to Avgerou and McGrath's (2005) analytic framework of rationality and emotionality in IS innovation, Hassenzahl's (2003) UX model affirms the inseparability of emotion and rational attributes in a human agent when applied to IS use (Attfield et al. 2011; MacDonald and Atwood 2014).

By drawing from Hassenzahl's (2003) UX model, perceived usability is found to describe UX as a pragmatic attribute that addresses the 'what' and 'how' of interacting with the technology (Hassenzahl and Monk 2010; Knijnenburg et al. 2012). Privacy concerns and choice goals are the situational factors that characterize UX (Knijnenburg et al. 2012). Other factors such as personal trust/distrust, control, domain knowledge, and demographics are grouped under personal characteristics and theorized to describe UX (Knijnenburg et al. 2012).

Six aspects which include "*instrumental, cognitive and epistemic, emotional, sensory, social, and motivational and behavioral*" are integrated as a typology of experience in the in the context of mobile-augmented reality (MAR) (Olsson 2013, p. 212). The instrumental category mirrors the rational actions of *empowerment, efficiency, and meaningfulness*. The cognitive and epistemic category holds *awareness, intuitiveness, control, and trust*. The emotional aspect typifies *amazement, surprise, playfulness, and liveliness*. Sensory has *captivation and tangibility* as its sub-elements, while social holds *connectedness, collectivity, and privacy*. Finally, the motivational and behavioral category talks about *inspiration, motivation, and creativity*. The categorization of UX by Olsson (2013) is argued to be limited by some scholars who hold to the theory of inseparability of rationality and emotionality in a human agent (e.g., Avgerou and McGrath 2005; Hassenzahl 2003; O'Brien 2010). However, Olsson (2012) argues that these elements do not influence UX; rather they describe it. UX in its own right is caused by the

interaction, content, and functionality of MAR services in its context-of-use (Olsson 2012).

Three central components: instrumental, non-instrumental, and emotional reactions are considered to be components of UX (Thüring and Mahlke 2007). This is done by drawing from Scherer's (1984) component theory of emotions (Thüring and Mahlke 2007). The instrumental captures *system usefulness and usability*. The non-instrumental holds the *aesthetic, symbolic, and motivational attributes*, while the emotional reactions consist of *affective aspects*. Similar to Olsson (2012), Thüring and Mahlke (2007) argue that the sub-elements within the three central components describe UX. UX on its own is caused by the underlying *system properties, user characteristics, and context/task parameters*.

Also, six factors are identified as engaging user experiences in user-system interactions (O'Brien and Toms 2010). Such factors consist of usability, endurability, aesthetic appeals, novelty, focused attention, and felt involvement. An empirical study by O'Brien (2010) confirms these factors as what characterize engagement-based UX in the context of online shopping. The work of O'Brien and Toms (2010), as well as O'Brien (2010), demonstrates that users are not only motivated by utilitarian elements, but also by emotions while-in-use of an IS innovation. To draw socio-economic sense as value-added elements to UX, brand experience (Jetter and Gerken 2007; Park et al. 2013) and user value such as usefulness/utility, symbolic, and social value (Park et al. 2013) are also considered.

3.3.2 Theme 2: UX distinct from Usability

Other scholars conceptualize UX as distinct from usability – mainly from hedonic and experiential effects – which may not involve usability (van der Geest et al. 2013). Hassenzahl and Tractinsky (2006) summarize this stream of UX research as focusing on non-instrumental qualities of a system. This includes emotion, experiential, and internal motivating elements, associated with human needs and values. Emotion is a visceral indicator of a positive or negative experience encountered in user-system interactions. Emotion is an important aspect of UX and influences how users make sense of, interpret, and interact with IS, as well as with future re-use of the

technology (Beaudry and Pinsonneault 2010; MacDonald and Atwood 2014). Thus, UX within this camp is defined as “a *momentary, primarily evaluative feeling (good-bad) while interacting with a product, [system] or service*” (Hassenzahl 2008, p. 14). By this definition, UX shifts attention from the pragmatic qualities akin to usability to more hedonic qualities of IS innovation. Such hedonic qualities include perceived enjoyability (Van der Heijden 2004), attractiveness (Kujala et al. 2011), aesthetic value or beauty (Attfield et al. 2011; Hartmann et al. 2008; Hassenzahl and Monk 2010; MacDonald and Atwood 2014; Pallud and Straub 2014), pleasure and fun (Hassenzahl et al. 2010; Wixon 2011). These qualities satisfy human needs, but have less instrumental value. Other hedonic qualities include excitement, happiness, anger, and anxiety (Beaudry and Pinsonneault 2010).

Anchoring on a psychological perspective, Hassenzahl et al. (2010) draw from self-determination theory (Ryan and Deci 2000) to affirm that good UX is about fulfilling human needs for autonomy, competency, stimulation, and relatedness while-in-use of IS innovation. Positive UX can also come from value fulfillment (Olsson 2012). The values here are psychological attributes, functions, and purposes that are essential in certain usage situations and contexts. Such psychological attributes include social values, emotional/hedonistic values, novelty, and excitement as forms of stimulation and epistemic values (Olsson 2012). Other values are traditional values such as self-actualization values, creativity, and self-autonomy (Olsson 2012).

Scholars adopt sense-making processes to situate their works in this camp as well (e.g., McCarthy and Wright 2004; Wright et al. 2004). The uniqueness of UX is contingent upon the kind of emotion users have during the interaction process (McCarthy and Wright 2004). Thus, users’ emotional reaction exits through the user-system interaction to shape behaviors which accumulate over time (Hassenzahl et al. 2010). The accumulated experience presupposes that people do not simply engage in experiences as ready-made during user-system interactions (Wright et al. 2004). Rather, they actively construct them through a process of sense-making that includes anticipating, connecting, interpreting, reflecting, appropriating, and recounting (Wright et al. 2004). IS innovation does not just give an experience, but creates the environment or circumstances in which users could have an experience through sense-making processes (Wright et al. 2004). By drawing from a content-based user

psychology theory, sense-making is conceptualized as apperception (i.e., to perceive new experiences in relation to past experiences) and is used to investigate the emotional interaction of technology (Saariluoma 2003; Saariluoma et al. 2013). Apperception, which is different from perception, holds a philosophical and psychological origin or value (Kant 1781[1999]; Locke 1689[1975]). Saariluoma (2003), Saariluoma et al. (2009), and Saariluoma et al. (2013) lean towards the psychological value dimension and define apperception as mental content or representation, caused by the activation of emotion and cognitive processes on the basis of past experiences. Based on this, *apperception* is empirically validated to describe user-technology interactions that are laden with emotional artifacts (e.g., Rousi et al. 2010; Saariluoma et al. 2009).

3.3.3 Theme 3: UX is akin to Satisfaction

Scholars within this camp regard UX as an extension of the concept of satisfaction, which is one among the three components of usability defined in the ISO Standard (ISO 9241-11 1998). Similar to the camp that views UX as encompassing usability, UX is defined within this camp as cognitive and affective impressions formed due to user-system interactions (Rose et al. 2011). Studies that draw from the expectation confirmation model (ECM) (Bhattacharjee 2001) position satisfaction as a key concept and such studies give little attention to UX. Nevertheless, satisfaction is argued as a construct that may contain valuable characteristics of UX. Users who have a positive brand experience with a system will definitely be the most satisfied and continue to use the system (Morgan-Thomas and Veloutsou 2013). Cognitive impressions that stem from ECM-related research such as perceived benefits/usefulness can reinforce positive UX (MacDonald and Atwood 2014). In addition, IS scholars have used signaling theory (Mavlanova et al. 2015), and the model of product-related deceptive information practices in e-commerce (Xiao and Benbasat 2011) to infer that perceived deceptiveness of a system (e.g. website) can trigger negative UX (Mavlanova et al. 2015; Román 2010; Xiao and Benbasat 2011; Xiao and Tan 2012). The moderating effects of UX on satisfaction were confirmed by Yoon (2010) who found that users with high UX are more satisfied when compared to those with low UX in the context of online banking technologies.

3.4 Knowledge Gaps within Existing Literature

- 1) As the review attests, while addressing varied ways of achieving emergent usage of IS, the associated arguments have not unraveled their causal mechanisms. The literature review has also reinforced the view and the need for this research. None of the studies reviewed so far has focused on mechanism-based explanations of why emergent IS usage exists, neither did such studies consider the context of adaptive e-financial systems. IS scholars have argued for the need to redirect IS research towards mechanism-based explanatory theory (e.g., Avgerou 2013; McGrath 2013; Mingers et al. 2013; Volkoff and Strong 2013). Also, none of the studies sampled focused on any e-financial system operating in the South African e-financial ecosystem, if we are to consider the causal impact of macro-contextual conditions in the design and use of such IS initiatives (Carlsson 2005; Charki and Josserand 2008). Despite the call, few or no studies have unveiled how causal theory is articulated in IS phenomena or what form causal mechanisms take in explaining the emergent usage of technologies that are societally implicated.
- 2) Considering the peculiarity of IT artifacts and their implications in the context of their study (Orlikowski and Iacono 2001), a few studies have focused on individual orientations, as shown by the literature reviewed so far. Studies have noted the importance of individuals as sources of novel practices outside the organizational context (e.g., Carroll et al. 2003; Salovaara 2008; Salovaara et al. 2011), but no in-depth studies have been published on the causal mechanisms generating such individualized usages.
- 3) Emergent usage of IS creates UX. This view has received very little attention in the IS field despite being a prominent research domain (Deng et al. 2010; Pallud and Straub 2014). The studies reviewed are almost all from HCI and most of them categorize the experiential factors that characterize UX as stand-alone rational-and-emotional-based dimensional models. Despite their valuable contributions, there is an inability to depict the ways in which rational and emotion are intertwined in technology use, and to account for how their interdependence shapes emergent usage. When actors use technology, they often do not engage solely the rational or the emotional aspect, but both dimensions. Few studies have yet attempted to recognize that

pure rational action is impossible and that the duality of rationality and emotionality exists in IS innovation (Avgerou and McGrath 2005; Ciborra 2002). Given the embeddedness of IS in everyday life by using financial mobile apps, factors that capture such a duality have to be identified. When particularized to the context of this research, the identification of such factors is important. This is because goal-directed behaviors of users in the technology are actions embedded in their emotions and such emotions trigger situated or unanticipated use of the system (Ciborra 2004; Ortiz de Guinea and Markus 2009; Patel 2012).

3.5 Research Agenda: Revisiting the Research Questions

A future research agenda based on the knowledge gaps identified from the synthesized literature is derived. The research will therefore address the issue, given the assumption that whether an individual or group, people still have something personal that they bring to their joint activities when interacting with an IS innovation. Thus, an individual's role as an independent user of technologies in an emergent way is very important, especially when the IS involve one user's interactions, as in this research phenomenon. To account for the observed knowledge gaps, the earlier formulated central research question is re-stated as:

❖ *Why does emergent usage occur in adaptive information systems?*

Recall that the aim of the research is to uncover the generative mechanisms that might cause the emergent usage of adaptive IS. However, such an aim cannot be achieved without understanding what describes the emergent user experience (UX). Such a UX is observable in the empirical domain of the critical realist stratified ontology, since actual usage equates with the consumption experience of the services that the technology affords. Thus, the sub research questions are restated as:

RQ1 *What experiential factors describe emergent usage of adaptive information systems?*

RQ2 *What generative mechanisms must exist for such emergent usage to be possible?*

RQ3 *What explains the relations of the mechanisms to effect emergent usage of such information systems?*

To answer these questions, there is a need to develop a conceptual framework from

the synthesized literature. Such a model will then act as a starting point towards developing the mechanism-based explanatory model of the research. To do this, the researcher exits to the second phase of the critical realist review, as illustrated in the 4-phase argumentative strategy framework in Table 3.

3.6 Phase 2: Extraction of Mechanisms and Factors from Synthesized Literature

After the review process in Phase 1 that showed the knowledge gaps, generative mechanisms are inferred and extracted, either from the core concepts or the relationship between the concepts in each of the seven themes (Okoli 2012; Rycroft-Malone et al. 2012). Originally, in line with critical realist assumptions, these key concepts were extracted in the form of deductive thematic coding, in the light of the review objective from the synthesized literature (Barnett-Page and Thomas 2009; Rycroft-Malone et al. 2012). As the literature attests, emergent usage of IS has been leveraged and actualized by individuals or organizations in a variety of research streams. Re-examining the themes via the lens of critical realism reveals the generative mechanisms associated with emergent usage of IS within each theme, as shown in Table 6 below.

Table 6: Overview of Literature Review and Critical Realism Implication in Abstracting Generative Mechanisms from the Synthesized Literature				
Proposed Typology	The Literature Synthesized			Critical Realism Implication (Real Domain)
Perspectives of thought	References	Theory/Theories Used	Level of Analysis	Concepts as Structures and Mechanisms Inferred from the Synthesized Literature
Design for new purpose of use	(Dix 2007; Dourish 1999, 2003; Fischer and Herrmann 2011; Hanseth and Lyytinen 2010; Heeks 2002; Pahlke et al. 2010; Patel 2012; Patel et al. 2010; Patel and Hackney 2010; Perry and Rachovides 2007; Pipek and Wulf 2009; Sengers and Gaver 2006; Tiwana et al. 2010; Wakkary and Maestri 2008; Wulf et al. 2008)	CAS theory, Theory of deferred action	Organizational	Versatility, reflexivity, flexible IS architecture, modularity, incremental adjustments, user community, visibility of users, persistence, playfulness and exploration, ambiguity into purpose of use, simplicity-in-design, adaptation, and deferred action
End-user development (EDU)	(Ahmadi et al. 2008; Amoroso 1988; Amoroso and Cheney 1992; Asand and Mørch 2006; Barker 2007; Brancheau and Brown 1993; Burnett and Scaffidi 2014; Fischer 2010a; Fischer and Giaccardi 2006; Fischer et al. 2004b; Fischer and Herrmann 2011; Giaccardi and Fischer 2008; Ko et al. 2011; Lieberman et al. 2006; Paternò 2013; Shayo et al. 2002; Zmud 1984)	Meta-design theory	Organizational	Underdesign, user motivation of being empowered, flexibility, local control of job environment, communicative empowerment of users, training-support, and endowed expertise
Bricolage and improvisation	(Alter 2014; Arora et al. 2010; Boudreau and Robey 2005; Ciborra 1992, 1996, 2004; Ciborra and Willcocks 2006; Hayes 2000; Heeks 2002; le Roux 2014; Magni et al. 2010; Molnar and Nandhakumar 2008; Orlikowski and Hoffman 1997; Teoh and Wickramasinghe 2011; Tjørnehoj and Mathiassen 2010)	Theory of creativity and spontaneity, Theory of bricolage and improvisation model of change, theory of workarounds	Organizational	Situational awareness, sense-making, mood, coping with limited resources, employee's creativity, motivation, empowerment in adaptation, embodied interactions in technology use, mediation, coordination, collaboration, and communication, experiences of misfits, system deficiencies, structural constraints, organizational readiness and practices, and employees' ability to execute a workaround
Appropriation	(Bar et al. 2007; Carroll 2004; Carroll et al. 2003; de Souza e Silva et al. 2011; Delaney et al. 2008; DeSanctis and Poole 1994; Dey et al. 2011; Dourish 2003; Fidock and Carroll 2011; Fuller and Dennis 2009; Lindtner et al. 2012; Orlikowski 1992; Rodon et al. 2011; Salovaara 2008; Salovaara et al. 2011; Stocker et al. 2012; Waycott et al. 2005; Wiredu 2007)	Structuration theory, Adaptive structuration theory (AST), Model of technology appropriation (MTA), Activity theory, Fit appropriation model (FAM)	Organization and individual	Motives, conditions of use, technology design properties, organizational structures, socio-cultural structures, embeddedness, unfaithful appropriation, system-task misfits, interpretive flexibility, and cognitive structures
Adaptation	(Ahuja and Thatcher 2005; Barki et al. 2007; Boudreau and Robey 2005; Boulus and Bjorn 2010; Convertino et al. 2007; Davidson and Chismar 2007; Davis and Hufnagel 2007; Desouza et al. 2007; Jaspersen et al. 2005; Mills and Chin 2007; Nan 2011; Park and Chen 2012; Rice and Rogers 1980; Saga and Zmud 1994; Schmitz et al. 2010; Singletary et al. 2002; Sun 2012; Tyre and Orlikowski 1994)	CAS theory, Coping theory, Theory of trying, Self-efficacy theory, Model of how people switch to active thinking from automatic thinking.	Organizational	Users' knowledge and skills, self-efficacy, benefits satisfying, benefits maximization, disturbance handling, self-preservation, novel situations, discrepancies in interaction, initiative to learn new uses, reflection-on-action, tinkering, learning new skills, adjusting work commitments, and self-adaptation
Customization and tailoring	(Germonprez and Collopy 2004; Germonprez et al. 2007; Germonprez et al. 2011; Hovorka and Germonprez 2011; Kwon and Kim 2011; Mathwick et al. 2010; Monk and Blom 2007; Oulasvirta and Blom 2007; Sundar and Marathe 2010; Sundar et al. 2012; Sunikka and Bragge 2012; Tossell et al. 2012; Wulf et al. 2008)	Theory of design, Personalization theory	Organization and individual	Sense of agency, autonomy and freedom, predictable decision-making process, exert control over system's functionality, users initiating actions on their own, innovativeness, aesthetic appreciation, resources embedded in the technology, and systems' affordances
Making the system's one's own	(Al Lily 2013; Allen et al. 2011; Barki et al. 2007; Harwood 2011; Hynes and Richardson 2009; Silverstone et al. 1992; Sørensen 2006; Sørensen et al. 2000)	Social shaping theory, Domestication theory, Activity theory, Actor network theory (ANT)	Organization and individual	Socio-cultural structures, social learning and influence, domestication, embeddedness, meaning ascribed, technology interactions, task-technology adaptation, and individual adaptation

Similarly, the synthesized literature on emergent UX is used to identify the key concepts. Such concepts are considered as experiential factors that describe the emergent usage of IS, as shown in Table 7.

Table 7: Factors that Characterize Emergent Usage experience (UX) of IS				
Proposed Typology	The Literature Synthesized			Critical Realism Implication (Actual-Empirical Domains)
Perspectives of thought	References	Theory/Theories Used	Level of analysis	Factors that Characterize Emergent Usage Experience (UX) of IS identified from the Synthesized literature
Usage experience (UX) encompasses Usability	(Attfield et al. 2011; Avgerou and McGrath 2005; Hassenzahl 2003; Hassenzahl and Monk 2010; Jetter and Gerken 2007; Knijnenburg et al. 2012; Law and Abrahão 2014; MacDonald and Atwood 2014; O'Brien and Toms 2010; O'Brien 2010; Olsson 2013; Pallud and Straub 2014; Park et al. 2013; Thüring and Mahlke 2007)	Typology of experience model (Buccini and Padovani 2007), User experience (UX) model (Hassenzahl 2003), Component theory of emotions (Scherer 1984), Components of user experience (CUE) model (Thüring and Mahlke 2007), Duality of rationality and emotion in IS innovation (Avgerou and McGrath 2005)	Individual	Domain knowledge, demographic attributes, self-identification, choice goals, empowerment, situatedness, efficiency and meaningfulness, awareness, intuitiveness, control, trust, distrust, amazement, surprise, playfulness, liveliness, captivation, tangibility, connectedness, collectivity, privacy, inspiration, motivation, creativity, system's usefulness, usability, aesthetic value, symbolic meanings, motivation, affects, user engagement, branding experience, and user value
Usage experience (UX) distinct from Usability	(Beaudry and Pinsonneault 2010; Hartmann et al. 2008; Hassenzahl 2008; Hassenzahl et al. 2010; Hassenzahl and Monk 2010; Kujala et al. 2011; McCarthy and Wright 2004; Rousi et al. 2010; Saariluoma et al. 2013; Saariluoma et al. 2009; Van der Heijden 2004; Wixon 2011; Wright et al. 2004)	Self-determination theory (Ryan and Deci 2000), UX model (Hassenzahl 2003), Content-based user psychology theory (Saariluoma 2003; Saariluoma et al. 2013; Saariluoma et al. 2009)	Individual	Perceived enjoyability, aesthetic value or beauty, pleasure and fun, excitement, happiness, anger, anxiety, autonomy, competency, stimulation, relatedness, social values, emotional/hedonistic values, stimulation and epistemic values, respect and commitment, safety values, autonomy, cultural values, sense-making, apperception/apperceived IS usefulness, self-actualization, and motivation
Usage experience (UX) akin to Satisfaction	(Mavlanova et al. 2015; Morgan-Thomas and Veloutsou 2013; Román 2010; Rose et al. 2011; Xiao and Benbasat 2011; Xiao and Tan 2012; Yoon 2010)	Model of product-related deceptive information practices in e-commerce (Xiao and Benbasat 2011), Expectation Confirmation Model (ECM) (Bhattacharjee 2001), Signaling theory (Mavlanova et al. 2015), TAM (Davis et al. 1989)	Individual	User satisfaction, perceived ease of use, perceived benefits/usefulness, perceived deceptiveness of the system/website, and brand experience

Up until this point, the researcher has only assembled the key concepts which are kept very close to the original findings from the synthesized studies, including identical concepts, as shown in Tables 6 and 7. To assemble the key concepts into a coherent whole in order to address the concern of the review objective has not yet been done. Neither has the researcher gone past the findings of the included studies to generate additional understandings or hypotheses. As noted earlier, the idea or step of going past the synthesized content of the individual studies has been identified by some as the defining characteristic of a literature review (Rowe 2014; Schryen 2013).

To achieve this takes the research to Phase 3, as illustrated in the 4-phase argumentative strategy framework in Table 3.

3.7 Phase 3: Identification of Generative Mechanisms and Factors

This stage of conceptual development from the literature reviewed is potentially challenging and subjective. It is heuristic and depends on the judgment and “*theoretical sensitivity*” of the researcher (Strauss and Corbin 1990, p. 42). The identified key concepts from the synthesized literature are seen as theoretical data (Layder 1998). Therefore, the generative mechanisms are identified from the concepts in Table 6 and abductively coded/classified into theoretical themes in relation to the review objective (Yu 1994). Each concept is compared with the previous concepts and coded for differences and similarities. Similar concepts receive an identical label and different concepts have a distinct label, culminating in a taxonomy of concepts. To abductively classify concepts/mechanisms is a means of placing the characters of the phenomenon into certain categories to help researchers make sense of the phenomenon; this plays a major role in making hypotheses (Peirce 1878; Yu 1994). Such “*hypotheses are not based on our sensory experience, but rather the very structure of the meanings themselves*” (Yu 1994, p. 8). Thus, to categorize these taxonomies of concepts into higher categories or theoretical areas, the research draws from Nan’s (2011) CAS model of IT use and the organizational emergence framework of Alaa (2009), which is also derived from CAS theory.

Nan’s (2011) CAS model of IT use postulates that technology use is an emergent/bottom-up IT use process with three interrelated elements: (1) individual agents (i.e., human and IT) “*that consist of the basic entities of actions, (2) interactions that refer to the mutually adaptive behaviors of such agents, and (3) an environment that represents the social organizational/[societal] contexts of IT use*” (Nan 2011, p. 505). The three interrelated elements interact to enable IT use to emerge as collective technology use patterns and outcomes.

Likewise, Alaa’s (2009) organizational emergence framework is a classification of underlying concepts that categorize CAS factors (i.e., mechanisms) of emergence into (a) *enabling structures*, i.e. structures that enable the dynamic properties to become effective, (b) *dynamics of emergence*, i.e. mechanisms that realize emergent properties, and (c) *controlling mechanisms*, i.e., mechanisms that balance excessive change with stability in the form of feedback.

Thus, the integration of both Nan's (2011) CAS model of IT use and Alaa's (2009) organizational emergence framework suggests that emergent usage of IS is caused by the interaction of generative mechanisms that are classified into four categories: (1) enabling structures that enable the dynamic properties to become effective, (2) dynamic mechanisms that operationalize the emergent behavior, (3) control mechanisms as feedback mechanisms, and (4) contextual conditions that capture the environment where the system is situated. These four categories capture the key mechanisms of the agents (human and IT). Such agents are the basic entities of actions or interactions within the environment. The environment represents the socio-organizational or individual contexts of IT use in a CAS framework (Nan 2011). By classifying the generative mechanisms using the four categories, as shown in Table 8, chains of inference are derived for building the real/explanatory arm of the research conceptual framework in the making.

Table 8: The Identified Potential Generative Mechanisms in the Real Domain and Contextual Conditions Source: Base on CAS Theory of IT Use (Nan 2011) and Organizational Emergence Framework (Alaa 2009)			
Enabling Structures	▪ Social structure ▪ Embeddedness and under-design ▪ Organizational structure ▪ Cognitive structure ▪ Modular and flexible IS architecture		
Dynamic Mechanisms	System functionalities ▪ System affordances ▪ Simplicity-in-design ▪ Adaptation ▪ Ambiguity into purpose of use ▪ Transparent interactions ▪ Technological mediation ▪ System-task misfits ▪ Versatility and self-reinforcement	Empowerment ▪ Empowerment ▪ Exert control ▪ Initiative actions	Cognitive capacities ▪ Creativity ▪ Initiative to learn new uses ▪ Endowed expertise ▪ Technological cognizance
	Personal Characteristics ▪ Sense-making ▪ Autonomy and freedom ▪ Motivation ▪ Innovativeness ▪ Mood	Social influence ▪ Social learning and influence ▪ Coordination ▪ Collaboration ▪ Communication ▪ Playfulness and exploration	Situational conditions ▪ Situational awareness ▪ Coping with limited resources ▪ Unfaithful appropriation ▪ Novel situations ▪ Discrepancies in interaction ▪ Domestication ▪ Local control of job environment ▪ Environmental uncertainties
Control Mechanisms	Self-Adaptation ▪ Software incremental adjustments ▪ Reflection-on-action ▪ Tinkering and learning ▪ Adjusting work commitments		
Technology operating Contexts	▪ Organizational/workplace systems ▪ Individual/mobile technologies ▪ Individual/e-commerce		

From Table 7, likewise, Avgerou and McGrath's (2005) analytic framework of rationality and emotionality is drawn upon, which is also similar to Hassenzahl's (2003) UX model. The researcher abstracts and categorizes only the concepts that reflect the emotion and rational duality of UX and anchors them together by the situatedness of the user's action. Avgerou and McGrath's (2005) analytic framework proposes the inseparability of rationality and emotionality of a human agent in IS innovation. It asserts that cognitive evaluation of daily use of IS innovation can give rise to emotions towards these systems. Besides, high levels of mood or conscious emotion demand cognitive processes before triggering an action (Baumeister et al. 2007; Ciborra and Willcocks 2006; Oja and Galliers 2011), especially in e-financial systems, since they regulate our internal state in a way that we can be prepared for a goal-oriented interaction and repurposing of the system (Salovaara 2008; Xenakis and Arnellos 2013). Research has also shown that performance expectancy/perceived usefulness may not be affective events per se, but mastery or exploitation of IS usefulness produces positive emotions. Also, insufficiency in attaining such usefulness is associated with negative emotions (MacDonald and Atwood 2014; Venkatesh et al. 2012). Software designers also react to this UX by embedding aesthetic structures into task-oriented systems to achieve emotive UX while-in-use (Venkatesh et al. 2012). By abstracting and classifying such concepts, or rather factors, as shown in Table 9, chains of inference are derived for building the empirical/the descriptive arm of the conceptual framework in the making.

Table 9: Experiential Factors that Characterize Emergent Usage Experience (UX) of IS at Actual-Empirical Domains

Source: Based on Duality of Emotion and Rational Framework of Avgerou and McGrath (2005)

- User empowerment
- User engagement
- User satisfaction
- Apperceived usefulness of IS
- Perceived deceptiveness of the system
- Security and privacy concerns

3.7.1 The Critical Realist Conceptual Framework

The critical realist conceptual framework that emerged from the literature is shown in Figure 12. The framework came to existence by the diagrammatical integration of Tables 8 and 9, in the light of Alaa's (2009) organizational emergence framework and Nan's (2011) CAS model of IT use. Such a framework is also situated in the ontological assumptions of critical realism in order to address the research review objectives. Gregor (2006) proposes that a framework/model or a "*theory must be represented physically in some way*" (p. 620) to make it "*accessible to more than one person*" (p. 621). "*Mathematical terms, words, symbolic logic, diagrams, tables, or figures*" are possible forms to be used to physically represent such a conceptual framework (Gregor 2006, p. 620). However, the researcher opted for "*diagrammatic representation [of the framework because it is] . . . crucial in describing and communicating . . . theorizations*" (Langley et al. 2013, p. 8).

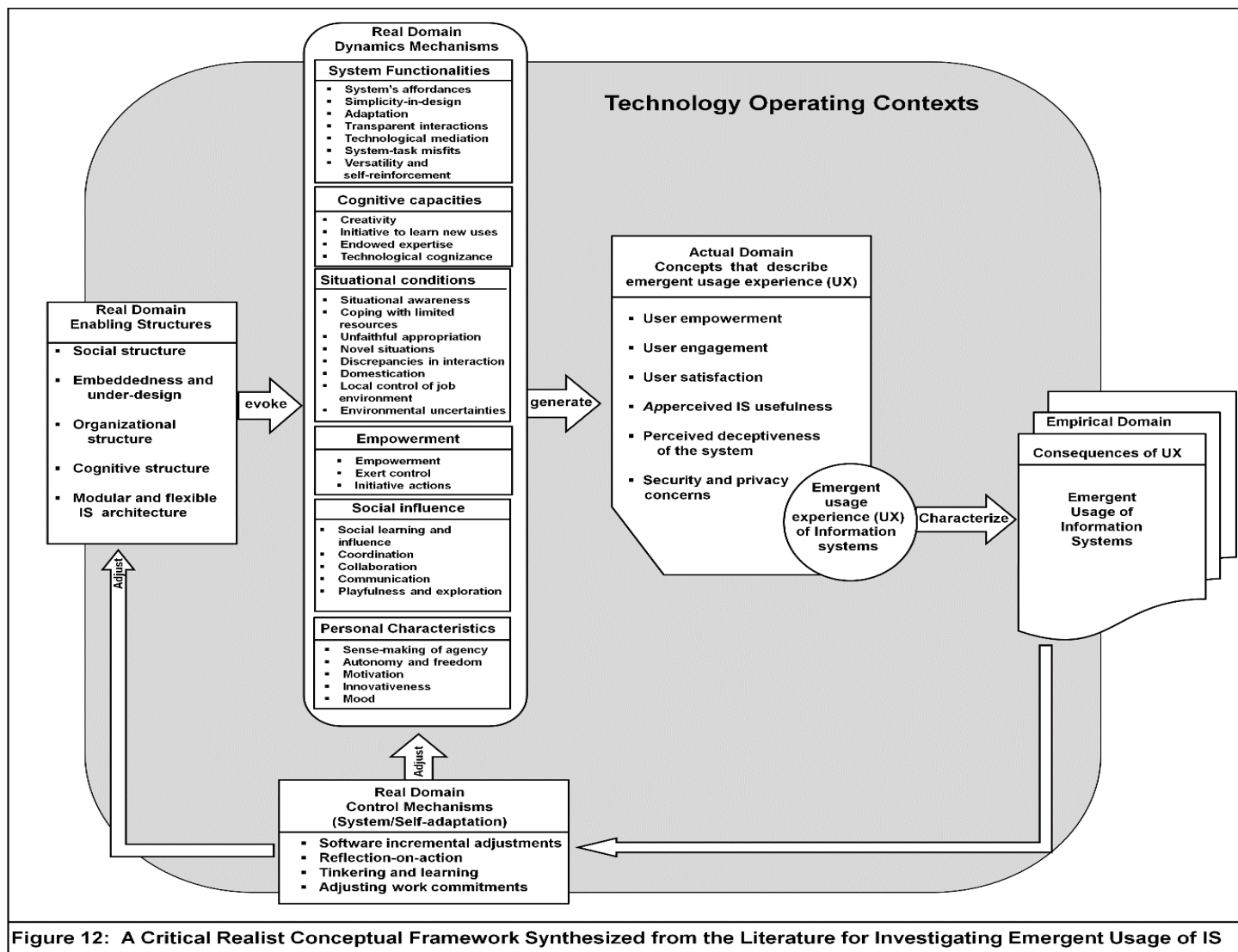


Figure 12: A Critical Realist Conceptual Framework Synthesized from the Literature for Investigating Emergent Usage of IS

The conceptual framework identifies the generative mechanisms that could explain systems' emergent usages. At the same time, it holds the non-causal experiential factors that could describe systems' emergent usage (Pallud and Straub 2014; Pucillo and Cascini 2014). As shown in Figure 12, the framework has the enabling structures as social structure, embeddedness and underdesign, organizational structure, cognitive structure, and modular and flexible IS architecture, which altogether in interaction evoke the effectiveness of the dynamic mechanisms. The dynamic mechanisms are classified into higher levels of system functionalities, cognitive capacities, situational conditions, empowerment, social influence, and personal characteristics. These higher levels hold smaller and more exclusive mechanisms at the lower abstract levels, as shown in Figure 12.

The enabling structures, when viewed in relation to the dynamic mechanisms, generate emergent usage of IS experience as outcomes. Such outcomes are characterized by user empowerment, user engagement, user satisfaction, apperceived usefulness of IS, systems perceived deceptiveness, security, and privacy concerns. The emergent usage outcomes influence the control mechanisms such as software incremental adjustment, reflection-on-action, tinkering and learning, and adjusting work commitments. Over time, the control mechanisms are used to introduce the reciprocal causal mechanisms which, in turn, re-adjust the enabling structures and the dynamic mechanisms to ensure a balanced emergent usage IS use on the basis of UX. The enabling structures, dynamic mechanisms, and the control mechanisms reside in the real domain; the factors that characterize the emergent IS use are in the actual domain; while the emergent IS use outcomes are domiciled in the empirical domain. These structures and mechanisms are assumed to interact within the technology's operating contexts, which in turn shape the behavior of the interaction.

Being a product of synthesized literature, the conceptual framework is a meta-theoretical framework (Meredith 1993). Meredith (1993) describes a meta-theoretical framework as the final objective of the process of theory construction. It involves the compilation and integration of previous studies' interrelated concepts and propositions used as principles of explanation and understanding. Such a meta-theoretical framework is used for the generation of new knowledge (Rowe 2012; Schryen 2013) and it could be generalized to other areas, but in this case the focus is

on adaptive IS for e-financial services. To do this, the researcher exits to the final phase (i.e., phase 4) of the critical realist literature review, as illustrated in the 4-phase argumentative strategy framework in Table 3 above.

3.8 Phase 4: Establishing Theoretical Coherence and Re-contextualization

The last phase of the critical realist review is to transform the conceptual framework into research avenues that capture the push beyond recognition of the research problem towards theorizing a solution (Rowe 2012, 2014). However, the synthesized conceptual framework is de-contextualized as it showcases the research gap, and those concepts identified in one setting may not necessarily be applicable to the phenomenon under investigation. Therefore, to avoid translating concepts into situations where they do not belong – for the research is not aiming to test theory – the researcher engages in: (1) establishing theoretical coherence (Berman 2013; Matthyssens et al. 2013), and thence (2) carrying out theoretical re-contextualization (Bygstad and Munkvold 2011b; Danermark et al. 2002).

To establish theoretical coherence, the conceptual framework is used as a starting point. It draws together complementary extant theories that underpin the reality within which the research is defined, in response to the distinct bodies of literature so far reviewed (Berman 2013; Matthyssens et al. 2013). Also, to carry out the theoretical re-contextualization, the established theoretical coherence is then used in the light of the initial empirical evidence to redescribe the research phenomenon. The entwinement of theoretical coherence and re-contextualization is actualized and discussed in Chapter 7 of this thesis, leading to the development of the theoretical model of the research (Danermark et al. 2002; Pawson and Tilley 1977). In contrast to a conceptual framework, the theoretical model of the research is a type of framework that is postulated to explain the phenomenon under study in an embryonic form (Pawson and Tilley 1977; Rowe 2012). At this point, the theoretical model is ready to be used to inform practice, with additional empirical evidence to unveil what it is about the emergent usage of adaptive IS that works, under what conditions, and why (Carlsson 2003; Pawson and Tilley 1977).

3.9 Chapter Summary

This chapter has demonstrated the potential of a critical realist perspective for the conduct of the literature review. The work is aimed at identifying knowledge gaps and developing a critical realist conceptual framework. The researcher does this because literature reviews are not epistemologically neutral; researchers explicitly or implicitly stick to a particular epistemological stance (Okoli 2012; Rousseau et al. 2008). As the approach can attest, a critical realist literature review is not a formulaic approach, but a creative logic of building explanatory theory from conceptual insights that already exist in prior studies. It is inherently flexible, iterative, and pluralist, embracing conceptual, quantitative, and qualitative studies from multi-disciplinary domains that speak about the phenomenon. It seeks for a causal mechanism explanation, driven by the review's objectives, to capture the phenomenon under study. Thus, the critical realist approach is not from ignorance to answer, but from some pre-existing knowledge to building a meta-model of emergent usage of IS that can act as a tool for future advancement of new knowledge in a different context.

Chapter 4

Extant Theoretical Foundations

“... IS researchers have an obligation not only to carefully select theories that can be adapted to the context at hand ...”

(Truex et al. 2006, p.798)

4.1 Introduction

This chapter discusses the extant theories of complex adaptive systems (CAS) and meta-design to ascertain their sensitivities or explanatory powers in underpinning the reality under investigation. Besides, the researcher offers an immanent critique of other theories that seem to explain the phenomenon, to show why they were not considered in this research. As Danermark et al.'s (2002) model advocates, building critical realist theory involves redescription of the phenomenon using theories selected from among rival ones. Such theory selection is based on the premise that there are still rational grounds for preferring one theory over another – hence the immanent critique of other competing theories (Bhaskar 1986; Mutch 2013; Peacock 2000). The chapter starts with a definition of a theory in IS research.

4.2 Definitions of Theory

Since the aim of research is to make theoretical contributions to knowledge, theory should be used to represent that knowledge (Gregor 2014; Markus 2014). Theory development is central in IS research and is considered as a primary output of research (Gregor 2014; Rowe 2012). Shapira (2011, p. 1320) sees *“theory construction as the highest level of scientific inquiry”*, while Lee (2014) concurs with Shapira's (2011) view by saying that *“what theory is cannot be separated from what science is”* (p. 1).

Theory is valued because it is practical (Van de Ven 1989) – practical in the sense that it enables *“knowledge to be accumulated in a systematic manner and the use of this knowledge to inform practice”* (Gregor 2006, p. 613). Theory is also regarded as useful because it provides an efficient means of abstracting, codifying, categorizing, holding, and integrating concepts (Mueller and Urbach 2013; Suddaby 2010).

The importance of theory in the IS field is widely recognized but there are *“conflicting or overly narrow definitions of theory and theoretical contributions”* (Gregor 2006; Markus 2014, p. 342). Weber (2012) defines a theory as *“a particular kind of model that is intended to account for some subset of phenomena in the real world”* (p. 4). To account, according to Weber (2012, p. 4), means the ability of the theory to assist its users to ‘explain’ and ‘predict’ its focal phenomena. Similarly, the term model reflects the simplified and concise representation of the subset of the real phenomena under investigation. Another variation of theory definition used in the IS discipline captures the Weberian (Weber 1949, 1978) version of theorization that stems from reconstructing a context of meaning to determine people’s behavior. For example, drawing from Strauss and Corbin’s (1998) grounded theory perspective, Sewchurran and Brown (2011) define a theory as a *“set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to describe and explain phenomena”* (p. 11). The integration of both definitions enables theory to take the shape of a conceptual network of statements, targeted at describing, explaining, and predicting real world.

4.3 Constituents of Theory

Constructs or concepts are one of the key constituents of theories (Mueller and Urbach 2013; Suddaby 2010). Constructs are higher order concepts since they refer to instances that are constructed from concepts at the lower level (Mueller and Urbach 2013). Concepts are abstractions of meanings of reality associated with certain events, objects, or conditions to which some word or words are assigned in order to be able to communicate about it (Bacharach 1996; Meredith 1993). Even though there is no clear distinction between concepts and constructs, constructs are *“broad mental configuration of a given phenomenon”* and *“approximated units”* of that phenomenon (Bacharach 1996, p. 500). They only exist in the world of

conception (Mueller and Urbach 2013). Therefore, constructs are hypothetical concepts not observable directly, but which can be inferred by observable events or ideas (MacCorquodale and Meehl 1948). The key purpose of constructs is to function as heuristic devices (Mueller and Urbach 2013). Such devices are used to make sense of the empirical beyond the individual observed instances of a phenomenon (Nunnally and Bernstein 1994). Constructs/concepts assume the role of mechanisms when they tell us why there is causal relationship between constructs, and when such explanations go beyond empiricist causal explanations (Avgerou 2013; George and Bennett 2005; Mingers 2006). Since empirically observable variables instantiate constructs (Bacharach 1996), variables may be viewed as an operational configuration derived from constructs which can be measured (Bacharach 1996; MacCorquodale and Meehl 1948).

More especially, when it comes to mid-range theories or theories of provenance (Markus 2014; Merton 1968), the clarity of constructs is very important in order to precisely understand what is being conceptualized (Suddaby 2010; Weber 2012). Suddaby (2010) suggests four criteria for improving the quality of constructs and the theories that hold such constructs. Firstly, empirical phenomena have to be re-contextualized into theoretical constructs by means of definitions. The definitions should be comprehensive, precise, and parsimonious (Suddaby 2010). Secondly, Suddaby (2010) emphasizes the importance of clearly defining the scope conditions of constructs since they contribute to building strong theories. Suddaby (2010) draws from Whetten's (1989) recommendation about what constitutes theoretical contributions to argue that a theory should provide answers "*to what the constructs are, how and why they are related, who the constructs apply to, and when and where they are applicable*" (Suddaby 2010, p. 350). Thirdly, Suddaby (2010) underlines the importance of *coherence* or *logical consistency* in order to create logical arguments that are theoretically consistent and integrated. Fourthly, the *relationships between constructs* have to be drawn out in a way that the reader can understand, possibly in a diagrammatic format (Gregor 2006; Langley et al. 2013).

Constructs do not make sense in isolation (Suddaby 2010). Constructs link themselves to form networks of associations with the observables (i.e., explanandum), which capture the empirical (Mueller and Urbach 2013; Suddaby

2010). Such links are the causal connections that enable researchers to draw conclusions about the dynamics and mechanisms of a phenomenon. Consequently, researchers propose explanations and/or predictions about their empirically observable behavior by reason of such links (Mueller and Urbach 2013). Such propositions are conceptual arguments about how and why certain constructs share relationships and the nature of these relationships. Bhattacharjee (2012) defines propositions as “. . . *tentative and conjectural relationships between constructs that are stated in a declarative form . . . must be empirically testable . . . and can be judged as true or false*” (p. 16).

The proposed relationships are not expected to hold true universally (Bacharach 1996; Whetten 1989). Therefore, theories that hold the proposed relations are constrained by their boundary conditions. The boundary conditions allow us to draw conclusions about the generalizability of the theory (Gregor 2006). Thus, a theory is created if there are: (1) constructs as the fundamental concepts captured by a theory, (2) propositions as the relationships among these constructs (except typological theory), and (3) boundaries that constrain the context in which the theory is applicable (Mueller and Urbach 2013; Whetten 1989). These constituents – constructs/concepts, propositions and boundaries – when interconnected, are referred to as a nomological network in some quarters (Mueller and Urbach 2013).

4.4 Different Forms of Theory

What constitutes the building blocks of a theory has just been introduced, but theories can assume different manifestations or forms based on their purpose (Gregor 2006; Markus 2014). Gregor (2006) suggests a set of five theory types where each corresponds to a different purpose. Theories for analysis were introduced as type 1 to capture the goal of making a description of the IS phenomenon. The goal of theories can extend beyond description of the IS phenomenon to enable explanations of why certain empirical observations occur. Theories for explanation (type 2) serve this purpose with emphases on causal explanations. Some theories can reliably predict observations in the form of testable propositions (theories for prediction: type 3) without explaining why the predicted outcomes occur. Some theories integrate both explanation and prediction into a comprehensive model (theories for

explanation and prediction: type 4). Acknowledging the fact that IS discipline is a science of the artificial (Gregor 2009; Gregor and Jones 2007), theories for design and actions (type 5) “*give explicit prescriptions (e.g., methods, techniques, principles of form and function) for constructing an artifact*” (Gregor 2006, p 620).

Markus (2014) expands our understanding of different manifestations of theories by proposing two new theory types: “*theories of the problem and theories of the solution*” (p.343). These theories complement Gregor’s (2006) set of five theory types; thus bringing the different types of theories in IS research to seven. Theories of the problem provide mechanism-based explanations of how and/or why the problem occurs, while theories of the solution, “*based on a good theory of the problem, identify what it would take to improve the problematic situation*” (Markus 2014, p. 343). Markus (2014) notes “*that theories of the problem and the solution . . . are distinct from Gregor’s (2006) theories of explanation and/or prediction, and theories of design and action* (p. 344). The differences hinge on the fact:

. . . that theories of the problem and the solution are more concrete, contextually specific, and/or phenomenon focused than explanatory, predictive, and design theories, and may not have the potential to evolve into IS theories of provenance. Nevertheless, good theories of the problem and theories of the solution really are theories, in that they explicate relationships among concepts and specify causal mechanisms and processes by which outcomes are believed to come about (Markus 2014, p. 344).

Besides the nature of theory, Markus and Robey (1988), as well as Burton-Jones et al. (2014), draw our attention to the fact that theories can be differentiated based on the forms of logical structure embedded in them. The logical structure can be conceptualized in three different forms as variance theories (Davis et al. 1989), process theories (Newman and Robey 1992) and system theories (Nan 2011). The conceptualization is based on: (1) the nature of the concepts/constructs such theories hold, (2) the change in the concepts/constructs over time, (3) the relationship among the concepts/constructs, and (4) the time ordering in the relationships among such concepts/constructs (Burton-Jones et al. 2014). Theories that hold the precursors as necessary and sufficient conditions for explaining outcomes are variance theories (Burton-Jones et al. 2014; Markus and Robey 1988; Mohr 1982). Variance theories dominate social research including IS discipline (Bacharach 1996; Pare et al. 2008).

About 80% of studies in leading IS journals on IT-use impact were found to have used a variance theory (Pare et al. 2008). Concepts/constructs in variance theory take the shape of properties of entities, often called variables, with varying values/qualities/intensities. The properties of entities do not change over time; rather it is the value/quality/intensity attached to such properties that changes over time. Emphasis is not on causal relationship among constructs, but on the correlation of the values/qualities/intensities (Bacharach 1996; Burton-Jones et al. 2014). Besides, the time ordering of the properties is not important (Burton-Jones et al. 2014).

Mohr (1982) advocates for process theories that posit that the precursors are necessary conditions for the outcomes, but they are not sufficient to cause the outcomes to exist. The outcome can occur under contingent conditions, but the outcome may also fail to happen (Markus and Robey 1988; Mueller and Urbach 2013). Because of the contingent conditions, *“there are possibilities of other, more powerful causal factors influencing the outcome, and evoke the possibility of spurious, epiphenomenal relationships”* (Mueller and Urbach 2013, p. 7). Process theory specifies concepts as entities that participate in, and are affected by, events or series of events sequenced in time. Such entities change over time and their relationship is probabilistically sequential with time (Newman and Robey 1992). Process theories are causal and non-deterministic (Liang and Xue 2009). They are also explanatory in that they explain what could have caused a certain outcome by specifying the necessary precedent events (Newman and Robey 1992). Unlike variance theory, quite a few studies have used process theory since Markus and Robey (1988) introduced it to IS discipline. About 20% of studies in leading IS journals on IT-use impact were found to have used a process theoretical perspective (Pare et al. 2008).

System theories, on the other hand, emphasize, on the whole, parts/subsystems, emergence, and interaction as concepts (Burton-Jones et al. 2014). System theories are scarce in IS discipline (Burton-Jones et al. 2014; Lee 2004), despite their natural fitness to investigate IS phenomena (Burton-Jones et al. 2014; Lee 2010; Nan 2011). The whole is the constituted effect of the emergent properties and it arises because of the interaction of the parts. The whole is irreducible to the parts that interact to form

it (Nan 2011). System theories explain the IS environment/ecosystem they are situated in and, because their properties emerge, entities can change over time (Burton-Jones et al. 2014). The time ordering of events and properties is very important (Burton-Jones et al. 2014). The concepts'/constructs' relationship of system theories are anchored on causal interactions with reciprocal links as feedback mechanisms that stabilize or destabilize the system (Clark et al. 2007; Nan 2011). The reciprocal causality and the concept of emergence distinguish system theories from process and variance theories (Burton-Jones et al. 2014; Mueller and Urbach 2013).

4.5 Range of Theory and Theoretical Contribution

Another distinguishing characteristic of theories can be derived from the range of theories based on their level of abstractions. For instance, there are grand theories, substantive/mid-range theories (Markus 2014; Truex et al. 2006), and theories that emanate due to *“the accumulated ‘body of knowledge’ about a particular concept of interest”* (Gregor and Hevner 2013; Markus 2014, p. 342). Grand theories are *“characterized by high levels of abstraction, large numbers of concepts [and] causal relationships* that refer to global ideas about individuals, groups, organizations, and societal situations of sociotechnical phenomena (Markus 2014, p. 342). Theoretical contributions are acknowledged to have been made when a grand theory: (1) is applied to a new context that may lead to the development of a mid-range theory (Avgerou 2013; Markus 2014; Merton 1968), (2) is used to *“derive new constructs as the basis for building a new theory”* (Weber 2003, p. viii), or (3) is used to re-describe a phenomenon that has *“been the focus of prior theories in a different way”* (Weber 2003, p. viii). Thus, a new theory is built that captures the redescribed/re-contextualized phenomenon (Danermark et al. 2002; Weber 2003).

Mid-range theories are adapted from abstract grand/reference theories and they are relatively IS context-specific with parsimonious concepts and explicit propositions that link antecedents with outcomes (Grover and Lyytinen 2015; Markus 2014; Merton 1968). For IS scholars who hold the mid-range theory view, theoretical contributions are made when we: (1) introduce new constructs into an existing theory, (2) delete construct(s) from an existing theory to achieve parsimony, (3) can

precisely define the constructs or re-conceptualize them in a different way to better account for the phenomena, (4) *“propose new laws of interaction among existing or new constructs of an existing theory”*, or (5) delete laws of interaction among existing constructs for *“a more-parsimonious account of the phenomena that are the focus of the theory”* (Markus 2014; Weber 2003, p. vii-viii).

The body of knowledge view of theory refers to when knowledge is added to the existing knowledge because of the re-conceptualization and operationalization of an existing theory that seems to explain a phenomenon (Gregor and Hevner 2013; Markus 2014). Within the body of knowledge perspective, theoretical contributions are made when we add *“something new such as a conceptualization, a proposition, a finding, or a measurement, to the current body of knowledge”* (Gregor and Hevner 2013; Markus 2014, p. 342).

The grand/mid-range theories are abstractions of the empirical. However, there are theories, for instance, meta-theories, which are theories about theories of the empirical world (Gregor 2006; Gupta and Bostrom 2009). Meta-theories transcend the empirical theories to *“outline ontological networks of constructs and relationships applicable over several areas of investigation”* (Gupta and Bostrom 2009, p. 689; Meredith 1993).

4.6 Theory in Critical Realist IS Research

The introduced definitions of a theory from Weber (2012), as well as Sewchurran and Brown (2011), are incongruent with the critical realist understanding of a theory. Despite their relevance, such definitions: (1) do not take into account explanatory causal mechanisms of why IS phenomena occur. It only focuses on causal explanation that is equated with meanings or description of observational regularities and correlations (Bhaskar and Danermark 2006; Mingers 2006), (2) only focus on the empiricist accounts. Such accounts hinder our efforts to establish ontologically deep causal theories. Besides, it sponsors methodologies that focus only on surface level observations that can be misleading (Rogers 2015).

Bhaskar and Danermark (2006), therefore, define a theory as a device or a model which specifies *“the tendencies of transfactually active mechanisms, which co-determine particular concrete events or phenomena”* (p. 283). Bhaskar and Danermark’s (2006) definition (the thesis’s focus) presupposes that theories should take the shape of causal theories that are context specific. It emphasizes as well as shifts the focus of science fundamentally from explanation based on successive events to explanations that are focused on enabling conditions and generative mechanisms (Bhaskar 1998; Rogers 2015). *“Generalization, in this view, is not legitimated by the empiricist’s collection of positive instances of correlations but through the development and elaboration of theories of causal mechanisms and models”* (Rogers 2015, p. 228; Tsang 2013). Bhaskar and Danermark’s (2006) definition also resonates with Markus’s (2014) explanatory theory of the problem and/or theory of the solution. Such theories are mechanism-based explanatory models which can be represented in the form of process or system theories (Markus 2014). Mechanisms become the building blocks of such theories rather than variables (George and Bennett 2005). Therefore, the focus of this thesis is on system theory that is case-specific, where mechanisms comprise entities that interact to produce an emergent outcome and can change over time, due to contextual conditions (Burton-Jones et al. 2014; Mingers 2014). The implication of such a theory in IS research is that theory can now provide a causal understanding that enables IS researchers and indeed the practitioners to understand the situated meaning of actions, rather than the cataloguing of behavioral measures that describe such actions (Rogers 2015).

4.7 Relevancy of a few Extant Theories for this Research

The sociomaterial constituents and their embeddedness in the IS innovation under investigation and why people adapt, reinvent, and appropriate such a system for personal relevance, regardless of designers’ intent, suggests the application of a few theories. Among such theories are Giddens’ structuration theory (Giddens 1979, 1984, 1989), the sociomateriality lens (Orlikowski 2010; Orlikowski and Scott 2008a), the morphogenetic approach (Archer 1995, 1998b), the complex adaptive systems (CAS) theory (Merali 2006; Nan 2011), and the meta-design theory (Fischer and Herrmann 2011). The choice of these theories is because they: (1) possess potential coherence with the mechanism-based conceptual framework synthesized

from literature, when placed in the light of the initial empirical evidence of the research, and/or (2) offer explanations that recognize the sociomaterial of the technology when explaining how or why people use IS in emergent ways.

The increasing permeation of certain aspects of our daily lives with IS, from social media to mobile financial apps, propels the intertwining of technologies and the social elements of our lives (Yoo 2010, 2013). Therefore, theorization should reflect such intertwining towards the sociomaterial constituents of the IS phenomena. To be prepared to theorize how individuals in our society are shaped and being reshaped in the light of such IS phenomena is one of the key motivations to consider these extant theories.

4.7.1 Structuration Theory

Giddens' (1979, 1984, 1989) structuration theory recognizes structures as abstract or virtual properties of social systems, not concrete or physical existing structures out there. From a structurational perspective, structure "*exists only as memory traces, the organic basis of human knowledgeability, and as instantiated action*" (Giddens 1984, p. 377). Therefore, no social systems possess structures, but rather they exhibit structural properties that come into existence through human interaction. Structures exist only when humans allow their actions to be shaped by these abstract properties, i.e., the duality of structure. Thus, social structures condition social practices by offering the context necessary to guide human actions towards establishing structural properties. Such structural properties thence shape individuals' intentional interactions, which in turn reproduce structural properties in a recursive manner. Stated succinctly, "*man actively shapes the world he lives in at the same time as it shapes him*" (Giddens 1984, p. 2).

Giddens (1984) goes further to suggest that human interaction is composed of structures as: (1) a system of semantic rules – *structure of signification*, (2) a system of resources – *structure of domination*, and (3) a system of moral order – *structure of legitimation*. By drawing upon such structures, human agents produce and draw from three modalities, namely, interpretive *schemas*, facilities used in the exercising power relations, and *norms* applied to *sanction* social behavior.

4.7.2 Structuration Theory in IS

Giddens' structuration theory has underpinned notable IS research (Jones and Karsten 2008). Among them, for example, is the adaptive structuration theory (AST) (DeSanctis and Poole 1994) that accounts for micro-level appropriations of IS that might be faithfully or unfaithfully attached to the spirit of the system (i.e., designers' intent embedded in the technical objects). Other IS scholars utilize Giddens' concepts of recursiveness, mediation, and duality of structure to propose a duality of technology (e.g., Orlikowski 1992; Orlikowski and Robey 1991). Such works help us to conceptualize *technology-as-artifactual structures* that designers embed into technology to instantiate their views and, at the same time, to conceptualize *technology-in-use* as a process whereby users appropriate the same technology in line with their own assigned meanings within an organizational or societal context. Thus, technology usage becomes a constitutive feature of organizational/societal structure, IT artifact, and agential intentions. Giddens' structuration theory has recorded high historicity in the IS field (Jones and Karsten 2008). However, despite its popularity, many IS studies have not faithfully represented Giddens' ideas of structure (Markus and Silver 2008; Orlikowski 2000). Therefore, the core premise of Giddens' structuration theory is muted in much IS theorization practice and fuels "*self-contradiction between premise and practice*", an act Smith (2006) refers to as theory-practice inconsistency.

4.7.3 Sociomateriality and IS Research

Orlikowski and Scott (2008a), as well as Orlikowski (2010) formulate the notion of sociomateriality and re-labelled 'technology artifacts' as material and 'technology-in-practice' as social, wherein both (i.e., social and material) are recursively entangled in such a way that there could be no social without material and no material without the social.

Sociomateriality that suggests the fusion of social and technology originates from Barad's (1996, 2003) agential realism that emphasizes a relational holistic ontology. It grants symmetrical and equal status through constitutive entanglement in practice to humans and technologies; it does not treat them as separate and distinct realities

(Kautz and Jensen 2012; Orlikowski 2010). The constitutive entanglement allows a processual/reconfigurable phenomenon to exist via agential intra-actions without reference to the pre-existing entities that make the phenomenon (Barad 2003; Orlikowski 2007). Thus, the phenomenon presumes to be a whole and inseparable, but could be analytically separated via agential cuts. The agential cuts allow exteriority around the phenomenon to be accounted (Kautz and Jensen 2012). The agential cuts here is not to forcefully disentangle the constitutive elements of the phenomenon, but to view the magnifying details of the phenomenon as a whole through a lens in order to effect local separation (i.e., identified the local parts of a whole) (Kautz and Jensen 2012). The notion of intra-action redefines the traditional concept of causality to mean performativity. Performativity is “*understood as the iterative intra-activity within a phenomenon*” (Kautz and Jensen 2012, p. 4; Orlikowski 2010).

Recently, IS scholars, for example, Jones (2014) and Cecez-Kecmanovic et al. (2014), have classified sociomateriality lens into two streams: strong and soft sociomateriality. Such a classification is based on how sociomateriality captures the relationship between the social and the material. The strong sociomateriality takes the shape of Orlikowski’s view. The soft side is the imbrication perspective of Leonardi (2011), where the social and the material are assumed to be distinct but interdependently interwoven in the form of interlock (i.e., imbricated) with each other. Imbrication rejects the idea of ontological inseparability and gives autonomy to both material and human agency (Mueller et al. 2012). However, due to intentions, human agencies hold primacy over material agencies (Mueller et al. 2012).

Leonardi’s (2011) imbrication perspective is closer to the critical realist view (Leonardi 2013a), except that it fails to address macro-level influences; it also fails to explain how the sociomaterial imbrications are shaped across space and time within a specific context (Mikalsen 2014; Mikalsen et al. 2014). Between the ends of strong and soft perspectives, Johri (2011) breaks middle ground with his sociomaterial bricolage concept. Such a concept supports inseparability as well as argues for the separation of the material from the social when collecting data. The critique of contemporary sociomaterial approaches, rendered by Kautz and Jensen (2013),

tends to support sociomaterial bricolage since things are seen as identifiable parts of a whole.

Orlikowski's (2010) view of sociomateriality is also critiqued by Mutch (2013, pp. 28-30) as "*taking the wrong turning*". Such a sociomateriality lens fails to acknowledge the pre-existence of structures. It also neglects the specificity about the material and the social structure within the broader context of practice (Mutch 2013). The sociomaterial assemblage of social and material inseparability leaves a void in terms of understanding what constitutes this assemblage. There is also a void in understanding how such an assemblage can be separated analytically or evolves over time and why (Alter 2012; Leonardi 2013a; Mutch 2013). The lack of understanding leaves researchers with uncertainty as to what to analyze and collect data about (Alter 2012; Mutch 2013). Several studies that had Orlikowski's (2010) sociomateriality as a lens tend not to pursue a wider analysis of the whole as asserted by the lens, showcasing the difficulty in empirically validating the theory (Jones 2014; Mutch 2013). Such studies in their empirical analysis of data still fall back on the notion of separateness and slide towards social actions (Nyberg 2009; Wagner et al. 2010).

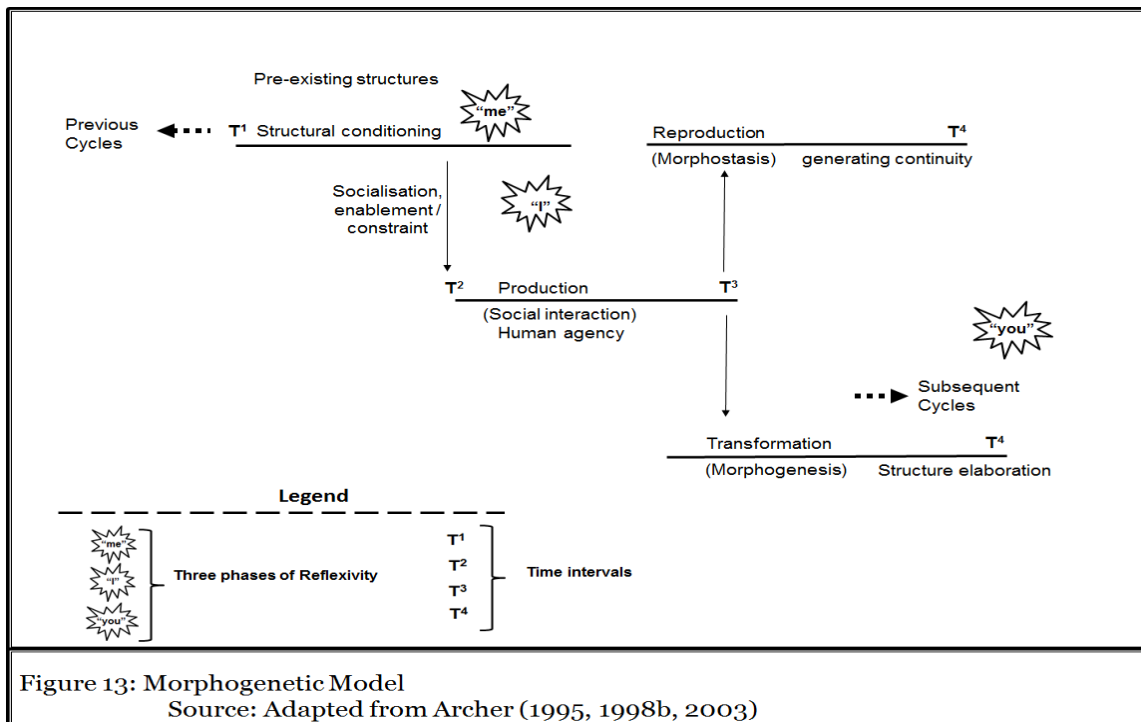
The sociomaterial concept is not peculiar to the sociomateriality lens, but has been embodied in a few theories (Mutch 2013), for instance, socio-technical ensembles (Bijker 1993), actor-network-theory (Law 1992), complex adaptive systems (CAS) theory (Nan 2011), meta-design theory (Fischer and Herrmann 2011), and morphogenetic theory (Archer 1995; Mutch 2010b; Ononiwu and Brown 2013; Volkoff et al. 2007). Each serves as a sensitizing device for theorization of the intertwining of the social and the material, but may not in some cases share the same assumptions of what constitutes reality.

4.7.4 The Morphogenetic Approach

The morphogenetic approach is a non-conflationist critical realist social theory developed by Archer (1995). Theories that conflate structure and agency, namely, actor-network theory (ANT), structuration theory, and sociomateriality are called conflationist theories (Mutch 2002, 2013). Archer (1995) crafts the morphogenetic

approach based on the concept of analytical *dualism*, to prevent the conflation of structure and agency, as in Giddens' *duality* of structure and agency (Mutch 2010b) or the *constitutive entanglement* of sociomateriality (Scott and Orlikowski 2013). By this, structure and agency are treated as autonomous entities in their own right, thus enabling the investigation of the relational interactions between structure and agency over time, as opposed to "*sinking one into the other*" (Archer 1982; Danermark et al. 2002, p. 182). The confluence of critical realism and the morphogenetic approach provide both an explanatory framework and an analytical history of emergence that depicts how pre-existing structures and agencies interact diachronically over different tracts of time. Such agency-structure interaction is because (1) structure necessarily predates the action(s) that transform it and (2) structural elaboration necessarily postdates those actions (Archer 2010). Archer's morphogenetic model, as shown in Figure 13, is the integration or rather the superimposition of Bhaskar's (1979) TMSA, Archer's (1995) morphogenetic approach, and Archer's (2003) internal conversation theory.

The morphogenetic approach considers structure to be of two types, namely, material structures and ideational structures (or culture), with emergent properties, because of the relations between social entities. Being considered as emergent because of agency interaction, the structures are irreducible to those social entities that interact to create them to showcase their relatively autonomous and enduring nature. Thus, Archer's (1995, 1998b, 2003) kind of structuration, as shown in Figure 13 in the form of a morphogenetic cycle, forbids any form of conflation of structure and agency.



As shown in the morphogenetic cycle, the **structural conditioning** at time T¹ depicts the causal powers of the pre-existing structures mediated through social agency in the course of its influence on agential actions (Bhaskar 1989). Structural properties such as artifactual structures or social structures could facilitate or constrain the present action of an agent (Archer 1995; Mutch 2010b). Structures which equate to macro-level perspectives play a major role in agents' reflexivity, prior to allowing the structure to influence their actions (Elder-Vass 2012). Structures give out certain conditional actions with a social cost. Agents, being the individuals, could conform or invent a means of circumventing such constraints posed by the structures. At this point, internal conversations on 'me', based on the emerging results of previous deliberation and the input of previous interactions, all work to condition the action at T¹. This first mode of internal conversation is what Archer (1995) calls communicative reflexivity, wherein actors rely mainly on other actors' shared input or social norms to boost confidence in the reflexivity process, before committing to the influence of structures with respect to the context (Archer 2003; De Vaujany 2008; Mutch 2010b).

The second phase is between T² - T³ where **social interaction** occurs (Cuellar 2010). During this phase, the agents actively and freely engage with the structures as

influenced by the structural conditioning. This phase depicts the ‘I’ to reflect the lonely and autonomous kind of reflexivity that agents engage in. Such reflexivity drives the performativity aim – although dependent on the individual interpretive schema – that specifically depicts the nature of the interactions for reproduction or transformation of the structures.

The last phase is the **structural elaboration** phase at time T^4 , where the modification of the previous structural properties yields either reproduction of the structure (i.e., morphostasis) or the structural transformation (i.e., morphogenesis). The change is mostly unintended by actors and produces a context with emergent properties as outcomes. The structure being modified is ready for the next cycle that will return to structural conditioning at T^1 . In this last phase (i.e., the ‘you’ phase) at time T^4 , agents/actors exhibit meta-reflexivity in their internal conversation (Archer 2003; De Vaujany 2008). Such a meta-reflexivity is reflected by individuals being engrossed in thoughts about their actions, having engaged with the social structures. The meta-reflexivity commits individuals to a project for which they are willing to pay a premium price (symbolic and material) to preserve their value. The individuals in this mode of meta-reflexivity seek for self-knowledge and indulge in self-critique for the sake of self-improvement and self-realization (De Vaujany 2008).

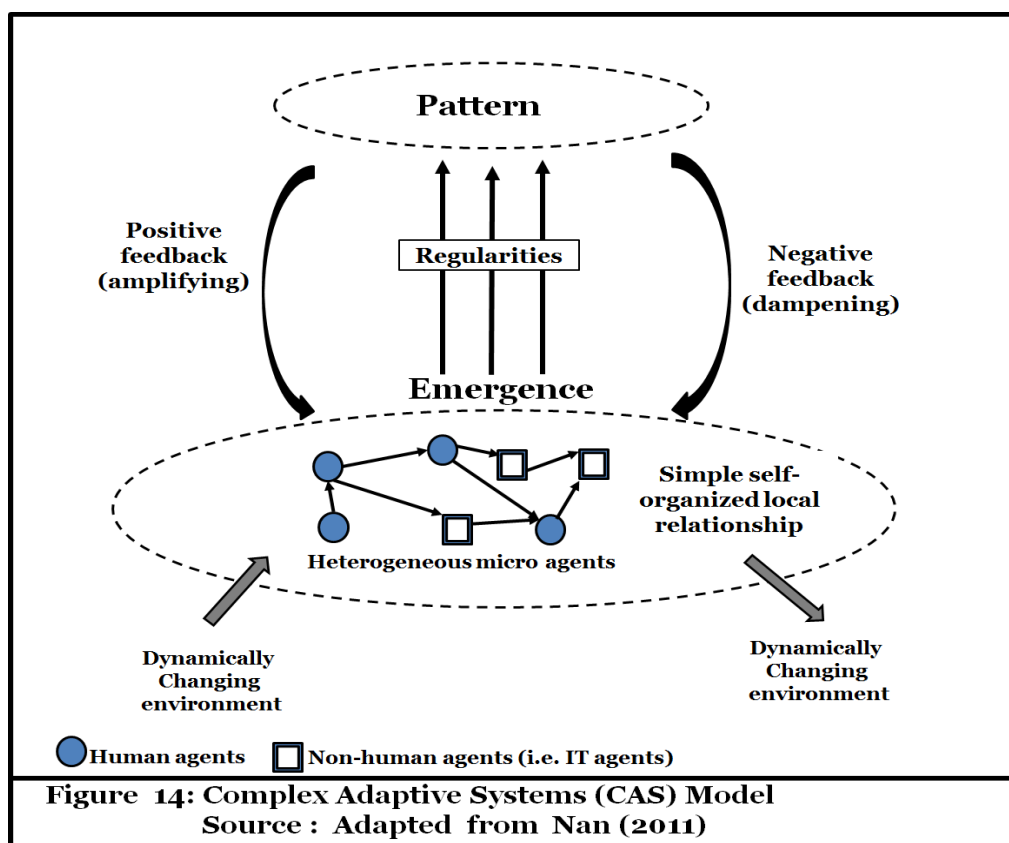
The three phases of reflexivity can be truncated, even at the embryonic level, into what Archer (1995) calls fractured reflexivity or near non-reflexivity, wherein individuals disconnect from internal conversations and follow the social transformation without reasoning (Archer 2003; De Vaujany 2008). The links connecting Phase 1 (T^1) and Phase 2 (T^2) consist of the distribution of “*vested interests*” and operate by presenting agents with different “*situational logics*” for attaining their interests (Archer 1995, p. 296).

4.7.5 Complex Adaptive Systems (CAS) Theory

CAS theory is a branch of complexity science that unpacks the adaptive behavior of interacting actors. CAS theory studies the “*behavior of large collections of . . . simple, interacting units, endowed with the potential to evolve with time*” (Coveney 2003, p. 1058). Similar to critical realist social ontology, CAS is an explanatory

theory. To use CAS to interpret an event is to proffer a form of explanation about the event. It is to explain how a particular structure or pattern of behavior has given rise to that event. CAS theory seeks to explain the research question: *Why does emergent usage occur in adaptive information systems?* A question of this kind refers to patterns or structures for which a CAS explanation is proposed.

CAS theory accounts for how global patterns/structures emerge from local interactions of structures with the agents as well as with the environment, as shown in Figure 14. Thence the environment provides the affordances for adaptation (Holland 1996; Michaels and Carello 1981), prompting Holland's (1996) use of genetic algorithmic simulation to situate affordances as key components of CAS theory (Nye and Silverman 2012).



Adaptation tendencies flourish in a CAS theory/model because of its flexibility or de-evolution/decomposition (i.e., returning to some previous characteristics). Other adaptive tendencies include intelligence, modularity, and malleability of the objects or agents (Williams 2011). Such adaptive tendencies offer the system the robustness

it needs to be potentially resilient. The adaptive tendencies maintain the system's viability and the capacity to co-evolve in the presence of risks and uncertainty (Booher and Innes 2010). Also, with sufficient diversity, the agents adapt to each other, and the system can reorganize its internal structure without the intervention of an outside agent (Booher and Innes 2010).

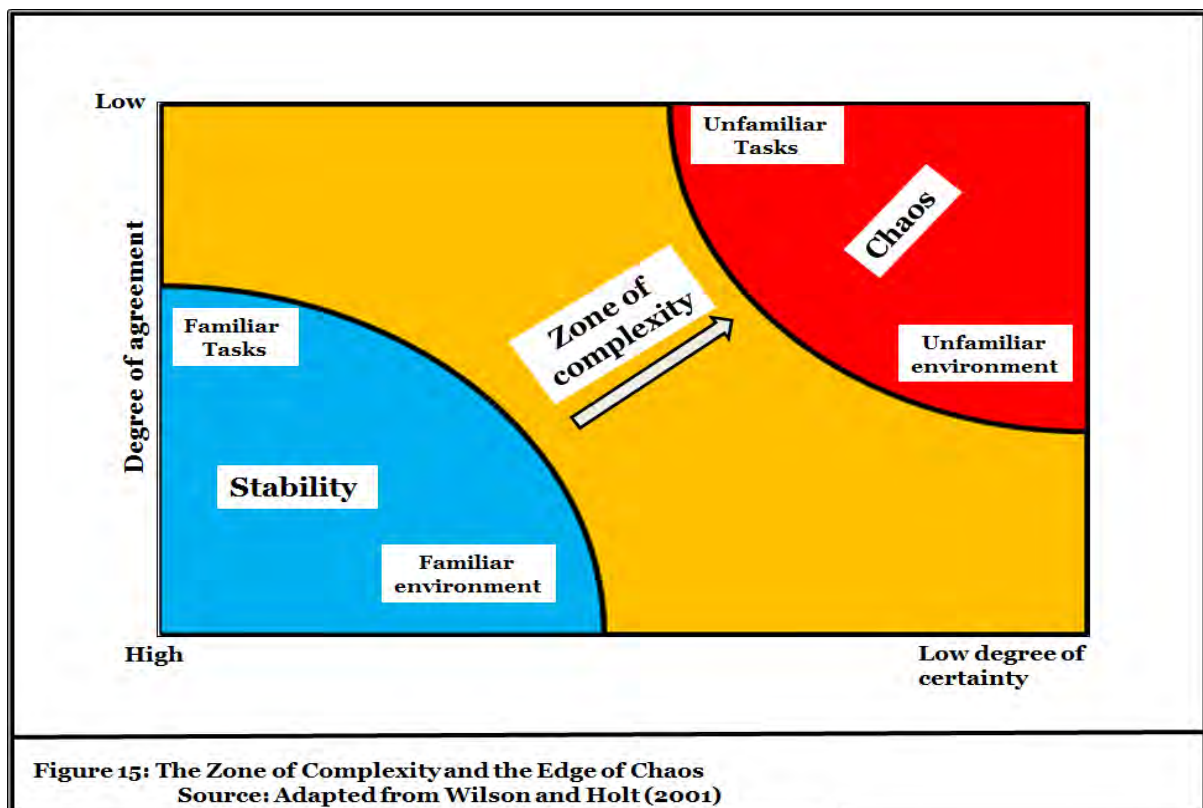
Scholars (e.g., Alexander 1964; Cilliers 1998; Holland 1994; 1996; Schilling 2003) provide more insights on the adaptive capabilities of CAS by saying that adaptive processes occur due to: (1) asymmetrical information (Cilliers 1998), and (2) system misfits (Alexander 1964; Holland 1994, 1996; Schilling 2003). CAS usually adapt and learn by engaging with asymmetrical information and system misfits, in accordance with their purpose of action, to foster resilience (Cilliers 1998; Folke 2006; Schilling 2003). In social CAS, resilience captures the adaptive capacity of the system to deal with change without a loss of essential functions (Folke 2006).

CAS approaches were pioneered by the Sante Fe Institute in California, particularly by the works of Gell-Mann (1994) and Holland (1995), via computer simulations. Their central insight from such simulation is that dynamic systems exhibiting complex behaviors could be explained or modeled by *"a limited number of simple rules/ [routines] governing the interactions of individual agents"* (Bousqueta and Curtisb 2011, p. 53). Such rules are adaptive through learning. Experiences are also gathered by the agents from their interaction with their environment with which they also co-evolve (Holland 1995; Nan 2011). Over time, *"historical evolution of the system manifests which highlights the importance of sensitivity to initial conditions and path-dependency"* (Bousqueta and Curtisb 2011, p. 53).

CAS theory is not a complicated system per se (Amaral and Uzzi 2007) and also it is not a single theory. Rather, it is a collection of overlapping and complementary theories, from a variety of both physical and biological sciences, to influence several disciplines (Amaral and Uzzi 2007). Walby (2007, p. 456) maintains that *"complexity theory is not a unified body of theory; it is an emerging approach or framework . . . it is a set of theoretical and conceptual tools; not a single theory to be adopted holistically"*. That CAS stems from the natural sciences does not debar its application to the social world (Bousqueta and Curtisb 2011). Notable social theorists

(e.g., Byrne 1998; Cilliers 1998) have stressed the importance of applying the widely accepted principles of CAS for understanding complex social systems. Thus, CAS theory has great potential in the IS discipline as a social-technical system, by providing a lens to explain the mechanisms behind emergent situations in adaptive systems, as social actors interact with technologies (Markus and Robey 2004; Merali 2006; Nan 2011).

CAS demonstrate non-linear behavior and are characterized by emergent creativity and learning that result from interactions among autonomous agents (Anderson 1999; Curseu 2006). Creativity and learning occur when emergence results in new unanticipated outcomes (Uhl-Bien et al. 2007). CAS theory highlights the properties and mechanisms of a bottom-up, self-organized, and feedback process in the micro-levels of interactions that yield emergent behavior (Nan 2011). Such emergent behavior is unknown in advance, but is observable at the macro-level in the form of regularities, because of the interactions of the micro-level elements (Antoniou and Pitsillides 2007).



Although chaos theory exists within the broad field of CAS, it differs from CAS, as shown in Figure 15 above. Chaos theory is concerned with systems of interconnected agents that exhibit uncertainty and unpredictable behaviors (i.e., chaotic behaviors); their effects are discovered from deterministic equations (Benbya and Mckelvey 2006a). In contrast, CAS theory deals with order and what causes order, especially at the 'edge of chaos' (i.e., the region between chaotic behavior and stability or the zone of complexity, as shown in Figure 15 (Benbya and Mckelvey 2006a; Tan et al. 2005). Being an order-creation science, it seeks to explain an emergent order that arises from agents' interaction, rather than the effects of energetic forces on objects (Benbya and Mckelvey 2006a). Such complex behavior is referred to as self-organization in some quarters (Bak 1996; Byrne 1998; McElroy 2003; Stacey 1992).

CAS and complex systems also differ. CAS are a special type of complex system that incorporate adaptation as a principal element in governing the dynamics and responses of heterogeneous individuals, or agent-level interactions (Sawyer 2005). Holland (1995) utilizes seven basic concepts to describe CAS, i.e., aggregation, flows, nonlinearity, diversity, tagging, internal models, and building-blocks, to explain the properties and mechanisms of CAS, despite the non-uniformity of describing its components.

CAS agents are individual actors that constitute the entities who carry out actions and adaptation (Byrne 1998; Holland 1995; Nan 2011). Agents can be human beings, technical objects, groups, or organizations, depending on the phenomena described by their respective unique attributes and behavioral rules (Nan 2011; Simon 1996). Due to the hierarchical arrangement of CAS, to ensure adaptation and evolution, agents are autonomous, independent, and interdependent in their operations (Simon 1996). Because of their relative independence, the bottom-up hierarchical level of organization occurs, not by controls, but through self-adaptation (Nan 2011; Simon 1996). By possessing attributes, agents gauge their fitness and capability, as well as distinguish themselves from other agents (Nan 2011). Because of these acts, agents can select interaction partners based on the similarity of their attributes.

CAS agents act in accordance with certain behavioral rules known as schema (or singular: schemata). Anderson (1999, p. 221) defines schemata as "*a cognitive*

structure that determines what action the agent takes at time t, given its perception of the environment". Since agents are not cultural dopes, behavioral rules/schemata assist individual agents to interrogate the structures of the environment and the behaviors of other agents, based on the local information collected, leading to reproduction or transformation of the structures and agents (Nan 2011). Behavioral rules elicit feedback from other agents and the environment, which could negatively or positively affect the fitness of the focal agents (Holland 1995). By this, a CAS is often referred to as being organized according to a few simple rules or routines guided by the agent's schemata. Also, structured entity in CAS environment (technical object or human) is deeply embedded in simple rules or routines that act as the '*guiding melody*' within which interactions occur to produce emergence (Davis et al. 2007; Gell-Mann 1994; Holland 1995). In this sense, agents are not necessarily prisoners of a fixed set of rules for a social order to evolve via their interactions and behaviors guided by their own schemata (Anderson 1999; Arkin 1998). Schemata, (often called interpretive schemata), is what agents use to attribute meaning to a set of circumstances (Dooley 1997; Lichtenstein et al. 2007). Agents can compete against one another internally, and also undergo single or double rounds of change through learning (Archer 1995; Simon 1991).

Agents' interactions in CAS are also linked to the connections and flows of resources within the system (Nan 2011; Rupert et al. 2008). Connections depict the linkages between human actors and the technical objects or symbolic agents in the case of user-system interaction (Simon 1996) while, for interpersonal interactions, linkages are established by human agents with similar attributes and schema. The concept of flow in CAS specifies the movement of resources through the web of agents and connections (Holland 1995).

The environmental concept in CAS is the external context where agents interact within the ecosystem (Epstein and Axtell 1996). Contexts could be physical or virtual landscape, organization, or social institution that constitutes the ambiance of interactions among the agents to influence the nature of the mechanism dynamics (Uhl-Bien et al. 2007). Examination of mechanisms and context provide insight into the 'black box' of the emergent behavior of CAS, and assist understanding of how and

under what conditions such behaviors occur. Environment structures co-evolve with the ongoing interactions of agents (Amaral and Uzzi 2007).

CAS has an extensive diversity by engaging several heterogeneous elements to work in union, due to their interdependence (Rupert et al. 2008). Because of such diversity, heterogeneous constituents of a CAS co-evolve at the same time to maintain a balance for survival (Axelrod and Cohen 1999; Rupert et al. 2008). Co-evolution is a recognition of the constant flux of change and agent adaptation in order to improve their fitness to the environment (Rupert et al. 2008).

Active adaptation of individual agents at the edge of chaos is the key to improving their fitness within the multi-dimensional landscape the agents inhabit. Such a landscape is also the domain where co-evolution and emergence occur (Pascale et al. 2000; Wilson and Holt 2001). CAS theory exhibits feedback mechanisms (Holland 1995; Mingers 2011). The feedback mechanisms could be positive (amplifying effect) and/or negative (a dampening effect), existing in the form of a loop (Uhl-Bien et al. 2007). The feedback loop and nonlinear relationships can create sensitivity to initial conditions which results in unpredictability. Sensitivity to initial conditions is a situation where small changes in the initial configuration may lead to large, non-linear effects (Allen and Varga 2006). However, the same characteristic pattern of behavior emerges despite the unpredictable changes, meaning that they are path-dependent. The emergence of order converges at point attractors (i.e., an enduring, but limited range of stabilized possible states) (Braa et al. 2007; Paley 2010). Outside the point attractors are the strange attractors, i.e., “*unstable spaces*” of attractions through iterations (Braa et al. 2007, p. 384). By feedback mechanisms, order can emerge around the attractors in an intermittent manner to create lock-in situations (Braa et al. 2007; Paley 2010).

4.7.6 CAS Theory in IS Research

The use of system theories, especially that of CAS, has been advocated by IS scholars (Curseu 2006; Lee 2010; Nan 2011), where IS use is a constituent of *emergent properties*. Nan's (2011) CAS model of IT use offers the conceptual description that aids IS researchers in gaining insights regarding causal pathways in bottom-

up/emergent IT use processes. CAS theory is drawn upon to formulate design rules that address adaptability issues and bootstrap problems (i.e., issues surrounding users' persuasion to adopt IS while the user community is non-existent or small) (Hanseth and Lyytinen 2010). The relevance of CAS theory in IS research is further exemplified by IS scholars: (1) using CAS to explain micro-macro level diversity (e.g., Allen and Varga 2006; Jacucci et al. 2006; Merali 2006), (2) making sense of the dynamics of emergence and co-evolution in IS phenomena (e.g., Allen and Varga 2006; Jacucci et al. 2006; Merali 2006), and (3) creating the emergence of enterprise system's project implementation (Radulescu 2011). Other applications of CAS theory include: (1) the impact of IT on a virtual team's emergence (Curseu 2006), (2) co-evolutionary IS software development processes (Benbya and McKelvey 2006a; Kim and Kaplan 2011; Vidgen and Wang 2009; Wang and Vidgen 2007), and the co-evolutionary development of IS alignment with organizational strategy (Benbya and McKelvey 2006b). This brief overview of the use of CAS theory in IS research highlights the paucity of studies using CAS (Jacucci et al. 2006; Lee 2010).

4.7.7 Meta-Design Theory

The meta-design theory is a substantive theory that draws from attempts at using complexity theory in the human-computer interaction (HCI) field. According to Fischer and Giaccardi (2006, p. 428), "*meta-design is a conceptual framework defining and creating socio-technological systems [STSs] in which new forms of collaborative design can take place*". This allows users to solve personally meaningful problems without developers' assistance (Fischer and Herrmann 2011). Besides, it is an IS design methodology for supporting the creation of evolvable and living systems that have open platforms. Thus, meta-design theory is not only oriented to explain IT artifact design, but also social contexts that allow end-users to participate in the process of design, while engaging in the appropriation of the system to solve individualized tasks (Ardito et al. 2009; Fischer 2000; Fischer et al. 2004a).

Giaccardi and Fischer (2008) consider the meta-design framework as addressing the need for STSs that: (1) include flexibility and evolution, because software design is never complete prior to use. Designers cannot anticipate and design for every

possible situation; (2) evolve to some extent in the hands of users to give the owners of problems the ability to modify them and gain unique experiences; (3) are designed for evolution to capture contexts in which change is intended or unintended; and (4) evolve in a distributed fashion to enable users to be distributed across space and time. Users are then empowered with the right type of tools, opportunities, and social rewards to extend such applications to fit their needs, rather than being forced to use closed systems designed beforehand (Fischer 2013; Giaccardi and Fischer 2008). As owners of problems, users can be active contributors engaged in creating knowledge, rather than passive users who are restricted to the consumption of existing knowledge.

Meta-design caters strongly for the emergence of situated and unintended consequences because of its fundamental assumptions that software designs do not end at the time of deployment. Rather, system survival and successful adoption hinge on continued user participation in a design-through-use environment (Fischer 2008; Henderson and Kyng 1991). Thus, meta-design theory: (1) extends boundaries by allowing users to be architects of their own usage in transcending the functionality and content of a deployed system; (2) creates IT artifacts that are subjected to critical reflection and adjustments; (3) supports intended and unanticipated uses; (4) encourages active learning and creativity while-in-use; and (5) distributes control among social actors in the design processes (Gorman and Fischer 2009; Hethrington 2009).

There are five principles suggested by Fischer and Herrmann (2011) to characterize the meta-design framework for the development and emergent usage of STSs. These include: (1) a culture of participation; (2) empowerment for adaptation and evolution; (3) Seeding, Evolutionary Growth, Reseeding (SER) Model; (4) under-design; and (5) structuring of communication for “*designing the in-between*” (Fischer and Herrmann 2011, p. 10-18).

Each of these five principles are briefly discussed, starting with a culture of participation.

4.7.7.1 *Culture of Participation*

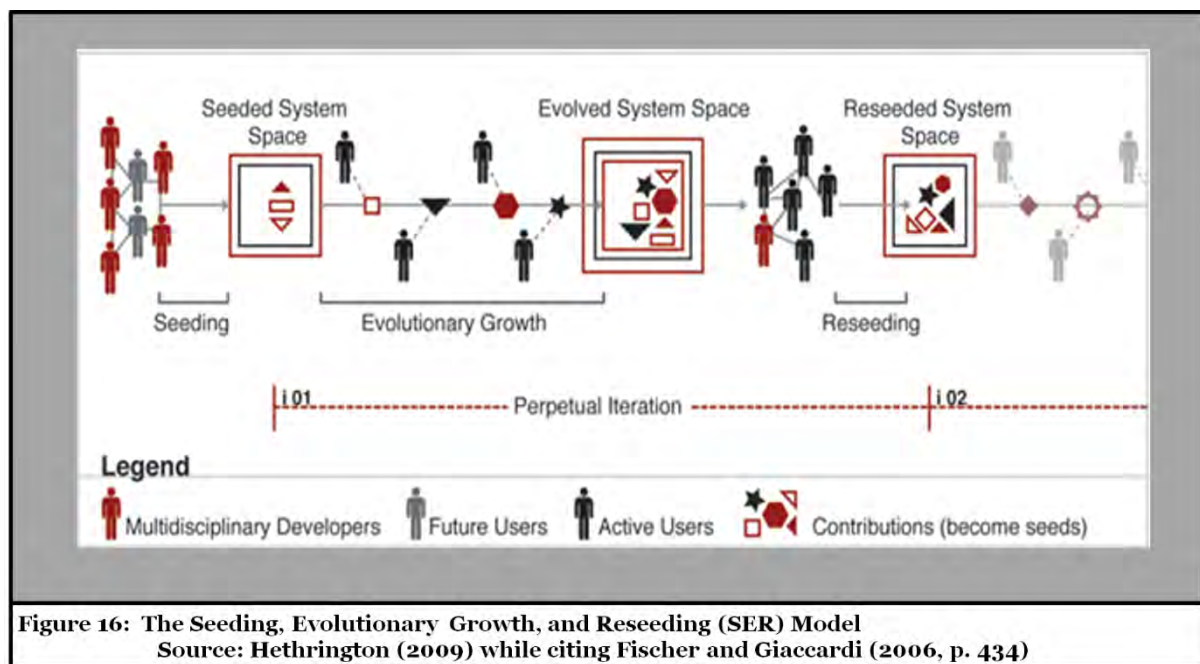
A culture of participation is reflected by active collaboration at both the design and use stage of a system established among stakeholders to exchange their perspectives (Giaccardi and Fischer 2008). Such diversity of people with varying competencies contributes to the shaping of the system's environments. Unlike participatory design where the artifact that emerges is still stable, static, and closed (Dourish 2004), a culture of participation provides the support for users to learn and engage with the system during design and use time and is geared towards having an evolving system (Fischer 2008; Fischer 2010b). By this, it gives a voice to the owners of the problems the system is intended to address in the first place, who are alienated because of imbalance in power structures, lack of knowledge, and information asymmetry, due to restricted communication from the designers on technical issues (Fischer and Herrmann 2011). Meta-design's notion of cultures of participation transcends the traditional participatory design by taking into account new developments in IS, such as agile software development (Lee and Xia 2010; Vidgen and Wang 2009), possibilities for end-user development (Fischer 2010a), and mass collaboration (Tapscott and Williams 2006) in which customers and developers tightly collaborate until the end of life of the application.

4.7.7.2 *Empowerment for Adaptation and Evolution*

End-user empowerment gives rise to the capability to modify or adapt the features of a socio-technical system without claiming to be experts in software design. End-users engage their interpretive flexibility to critique the functionality of a system through reconfiguration, without the consent of the original designers. By doing so, they benefit from end-user scripting of the digital structures, they understand the rules and processes associated with the socio-technical system, and they co-join in offering help during the system's development, adoption, and appropriation. Apart from scripting of digital structures or adaptation of the system, end-users contribute to the development of social conventions, organizational rules, and definition of tasks, as well as other contributions.

4.7.7.3 Seeding, Evolutionary Growth, and Reseeding (SER) Model

The continual evolution of STSs at use time is conceptualized by meta-design's *Seeding, Evolutionary Growth, and Reseeding* (SER) model, as shown in Figure 16. It acknowledges Simon's (1996) premise that complex systems must constantly evolve in order to be effective. The SER model differs from an iterative process of design practice of project-based situations because its operations are open. It starts at use time and continues until the system's end of life, ensuring adaptability and continued efficacy to enable the system itself to viably persist (Giaccardi and Fischer 2008; Hethrington 2009). Being an open system environment, its operations align with what Buchanan (1992) refers to as "*the indeterminacy of wicked problems [where] the problem for [software] designers is to conceive and plan what does not yet exist*" (p. 17).



As Figure 16 attests, the crafting of the SER model starts at design time with developers and selected future users. They initially develop the basic material and social structures of the system, leaving space and options for further development of a concrete system. This process is what Giaccardi and Fischer (2008) refer to as seeding. From the full maturity of the seeding stage arise under-design mechanisms where structures and processes are only partly specified. Thus, the "*structurally important parts*" of the system are developed by the software scripting experts with

malleable components (Fischer and Herrmann 2011, p. 9). Such malleable components are offered to the users by the designers to easily “*modify to their needs because their personal knowledge is [highly] relevant*” (Fischer 2010a, p. 59).

4.7.7.4 Under-design

The under-design concept differs from building a complete system. Rather, it focuses not on developing solutions, but on the contents and tools that users could appropriate to provide contextualized support. The contextualized support includes *reflection-on-action of users* in the system’s environment, with the support of the software designer (Giaccardi and Fischer 2008; Schön 1983). The system acknowledges the necessity to evolve – hence the evolutionary growth stage of the SER model, as shown in Figure 16. The system develops further through the contribution of users, creating an evolved system space that seems fragmented, because each user is creating personalized solutions rather than creating reusable information that others could build upon. Therefore, the reseeding phase, as shown in Figure 16, is where the incremental and fragmented changes are brought into a coherent whole by the designers and generalized for others to utilize, thereby supporting the next cycle of evolutionary growth and reseeding (Fischer and Herrmann 2011).

Between the evolutionary growth and reseeding stages, users adopt critiquing and re-use mechanisms. Such mechanisms support transcendence of their individual minds to “*cope with their emergent needs and practices . . . [and] they highlight constraints and even potential failures (i.e., critiquing) of the system*” (Giaccardi and Fischer 2008, p. 26). The critiquing scenario supports Schön’s (1983) concept of *reflection-on-action* or the concept of feedback mechanism in CAS theory (Nan 2011), where the activities of the users talk back to the design situation in varying degrees, depending on the individual creativity, skills, and experience. Also, within this space, users develop affective mechanisms because of the high perceived value of the system. Thus, the SER model postulates that adaptive IS continue to evolve to sustain their usefulness over time and space. It “*continually alternates between periods of planned activity and unplanned evolution, and periods of deliberate (re)structuring and enhancement*” (Fischer 2010a, p. 58).

4.7.7.5 *Structuring of Communication*

Meta-design theory conceptualizes communicative delivering methods to support co-evolutionary and co-creative behaviors among stakeholders (Fischer and Giaccardi 2006). One of these methods is the socio-technical walkthrough (STWT) workshop (Herrmann et al. 2007), to give users the opportunity to decide how a system should be shaped and used collaboratively. It offers users a forum for both designers and users to: (1) learn and express their experiences, and (2) demand adaptation and how to bring such adaptation into reality. This is because such a software design scenario demands the negotiation of design decisions and integration of knowledge among the stakeholders (Fischer and Herrmann 2011).

4.8 Immanent Critique of Extant Theories

Having developed a fair understanding of extant theories that seem to explain the IS phenomenon under study, an immanent critique of structuration theory, socio-materiality lens, and morphogenetic approach is rendered, as shown in Table 10. The critique also showcases the reasons why these theories were not selected in this thesis, despite the identified strength of some of the theories. Besides, the weakness of the selected CAS theory is acknowledged, for no theory is perfect. For instance, the CAS theory in its pure form does not cover emergent behavior that pertains to IS use (Sedera and Zakaria 2008). Another major critique of CAS theory is its refusal to explicitly name any structure/mechanism despite being manifested within different relationships of structures/mechanisms that also influence its evolution (Nan 2011; Stacey 1995; Tredinnick 2009). However, by following Nan's (2011) work, CAS theory is adapted in the research context and further fortified by bringing in meta-design theory that has definite structures/mechanisms that specifically cater for emergent IS usage (Fischer and Herrmann 2011). Reasons for selecting theories of CAS and meta-design in the light of the initial empirical evidence are discussed in Chapter 6.

Table 10: Immanent Critique of Structuration theory, Sociomateriality Lens of Orlikowski (2010) and Morphogenetic Approach as Pertains to the IS Phenomenon Under Investigation				
#	Weakness of Adopting both Structuration Theory and Sociomateriality Lens in the Thesis IS Context as Informed by Critical Realism	Strength of Adopting both Structuration Theory and Sociomateriality lens in the Thesis IS Context as Informed by Critical Realism	Weakness of Adopting Morphogenetic Approach in the Thesis IS Context as Informed by Critical Realism	Strength of Adopting Morphogenetic Approach in the Thesis IS Context as Informed by Critical Realism
1	Both theories unduly privileged human agency. Undermine the causal efficacy of material agency and embeddedness of social structures in the IS under study (Cuellar 2010; Markus and Silver 2008). IS use is only captured by performativity in practice. Thus, emergent IS use becomes only by practice or by constitutive enactment. The autonomy and pre-existence of <i>“IT artifact has historically tended to disappear . . .”</i> in core IS theorization by both theories and studies that used them (Jones 2014; Tiwana et al. 2010, p. 677).	Not applicable	The theory is more of processual and historical explanation of an emergence than eliciting distinct mechanisms (Muranga and Merali 2013) that could create such an emergence. Thus, the theory is non-propositional enough to enable the researcher identify distinct mechanisms that could cause emergent IS usage (Nan 2011; Ononiwu and Brown 2013).	Structure exists in the realm of artifactual, social, material, and ideation (Fleetwood 2005; Archer 1995; Mutch 2010b), while social exists in the realm of human action (Mutch 2010b).
2	Virtual/abstract nature of structures in the case of structuration theory. Structure is seen to exist as material- <i>cum</i> -social in an interpenetrative realm of inseparability in the case of sociomateriality. These views of structures from both theories do not reflect the structures of IS under investigation seen as specific, concrete, real with causal efficacy, and could pre-exist actions (Mutch 2013). Besides material, IS structures can also exist as ideation (media contents) or even physical – hardware/software as bearers of digital materials (Faulkner and Runde 2013; Siles and Boczkowski 2012) independent of humans, despite been constructed by humans (Polites and Karahanna 2013).	Not applicable	The theory did not provide an explanation for the reciprocal process whereby a macro pattern feeds back and influences the actions of micro-agents to achieve a self-reinforcing feedback cycle (Benbya and McKelvey 2006a; Mingers 2011). By this, IS researchers can understand how the actions of individuals (i.e. micro-agents) give rise to distinct macro behaviors and how the macro behaviors influence the behaviors of individuals (Bousqueta and Curtisb 2011).	Use of an <i>analytical dualism</i> to separate structure from social action. Structure is seen as emergent properties that could be reproduced or transformed as a result of human interactions.

3	Absence of temporality due to conflation of social and material, i.e., a-historicity of structuration theory and sociomateriality lens. Going by this how emergent IS usage under study is sustained and changed overtime could simply be ignored (Leonardi 2013a; Mutch 2013).	Not applicable	Without accounting for vertical explanation, the morphogenetic approach could not link events and experiences to their underlying generative mechanisms (Oliver 2012).	By the ontological separation of social from material, IS researches that adapted the theory could shift locus of explanation, from what things are to why they may happen.
4	Since both theories cannot account for the <i>“the linkage of individual micro-level action and macro-level institutional processes”</i> overtime (Jones 2014; Jones and Karsten, 2008, p. 150). The researcher could be <i>“misled into overlooking the important interactions of the IT artifact with its internal and external environment”</i> (Tiwana et al. 2010, p. 677).	Not applicable		The theory has an explicit concept of temporality that helps in theorizing how practices are sustained and changed in the emergent IS usage phenomenon overtime.
5	Both theories have a duality of structure and agency that ignores the autonomous interactive effects of entities. Such a duality <i>“precludes an examination of ‘becoming’ and shifts the focus to what ‘is,’ making both theories to be well situated for descriptive studies”</i> , rather than explanatory studies (Leonardi 2013a, p. 66). Thus, by using such theories as descriptive, why emergent usages occur in this IS innovation will be ignored.	Not applicable		
6	Being fitted for descriptive studies, therefore, empirical IS researches that will adapt both theories cannot provide a clear normative advice to practitioners in taking effective actions (Hirschheim and Klein 2003; Jones and Karsten 2008; Mutch 2013).	Not applicable		

4.9 Chapter Summary

This chapter discussed extant theories that seem to be connected to the investigation of emergent usage of adaptive IS. The researcher began by demonstrating what a theory should be in critical realism. An immanent critique of Giddens' Structuration Theory, the sociomateriality lens, and the morphogenetic approach were rendered. Consequently, theories of CAS and meta-design, deemed fit to have resonated with the objectives of the research, were selected. While the likelihood of these theories competing to be used for (re)describing the phenomenon was demonstrated, the researcher's stand is that no theoretical perspective guarantees privileged access to truth (Cecez-Kecmanovic et al. 2014). However, the aim is to offer immanent critique of theories that opens up their explanatory powers in the light of the empirical evidence. Thus, the researcher is empowered to select the theories that are best suited for the research context (Bhaskar 1986; Peacock 2000). As rightly pointed out by Dobson (2001a, p. 289): *"Walsham [(1993, 1995)] suggests that different theories provide different, but not necessarily better, perspectives on a situation. Critical realism, in contrast, suggests that there are, in fact 'better' theories judged on the basis of their ability to explain the relevant research phenomena"*.

Having gained a useful insight into the extant theories and prior knowledge from the synthesized literature, the next thing prior to theoretical redescription is an explication of the context of the research. This is because in critical realist approach *"... it appears necessary first to assess the rich phenomena that emerge from people's interactions ... in order to gain an initial understanding of these phenomena"* (Walsh 2014, p. 20; Wynn and Williams 2012). Thus, the next two chapters will give us a clearer insight of the phenomenon by discussing the context of the research. By this, one can render reasons why the selected theories were useful for theoretical redescription in the light of the empirical evidence gleaned from the fair understanding of the context (Bygstad and Munkvold 2011b; Danermark et al. 2002).

Chapter 5

Research Design and Methods: Phase 1 Preliminary Evidence

“... *knowledge is not immune to empirical check* ...”

Sayer (1992, p. 5)

5.1 Introduction

Having laid the conceptual foundation and the extant theories that seem to reflect the reality under study, the next move towards theoretical redescription is to understand the context under investigation (Wynn and Williams 2012). In order to explore context, an appropriate research design is needed. Research design is defined as the ongoing overall strategy, including data collection and analysis, a researcher deploys throughout the study in order to effectively address the research problem (McDaniel et al. 2009; Robson 2002). Research design is not seen as “*a prescription that defines what to do when, but rather the development of tentative guides for action*” that enables the researcher to learn in response to observed changes in the research environment (McDaniel et al. 2009). Thus, the research design for this thesis is a single case-study that is a dynamic system of inquiry that co-evolves during the research. It consists of an exploratory, in-depth, preliminary step as **Phase 1** that morphs into an explanatory step as **Phase 2** of the research design (Easton 2010b; McDaniel et al. 2009; Silva and Hirschheim 2007). The exploratory case-study step captures the preliminary multiple data collection strategy used to explore, discover, and describe events, activities, forces, and contexts that shape a system’s emergent usage. The explanatory case-study step will be used when the research model has been derived for its empirical corroboration (Wynn and Williams 2012).

While the overall case-study phase and its exploratory segment are discussed in this chapter, the explanatory case-study phase is reserved for Chapter 8. The adoption of exploratory case-study strategy in the preliminary phase of the overall research design is to understand the phenomenon under study, as it is the starting point of any critical realist IS research (Wynn and Williams 2012). To understand the phenomenon, therefore, requires thick descriptions of the events, sequence of actions, and their reinterpretation. This exposes the structural elements or causal mechanisms that will assist in later theoretical re-contextualization (Danermark et al. 2002; Wynn and Williams 2012). Such an understanding also gives insights that orientate the researcher towards discovery and analysis of the context. These help in illuminating the phenomenon and for selecting theories on the basis of letting the case speak (Grover and Lyytinen 2015; Johns 2006; Siggelkow 2007). The exploratory case-study also captures stage 1 (i.e., description) of the Danermark et al.'s (2002) model of critical realist research.

Description as it pertains to this study requires a detailed account of the context, the activities, the participants, and the processes shaping the emergent usage of the technology. Thus, the researcher is interested in four primary research goals as the purpose of this exploratory case-study. First, the South African e-financial ecosystem within which the technology is situated and functions has to be described. Through this, any socio-economic macro structures that may be shaping the system's emergent usage could be inferred. Second, there is interest in understanding the case organization, its structure and business model, daily work activities of the key employees relevant to this research, and events that occur, starting from the launch of the system to users' acceptance and appropriation. With this kind of understanding, the causal structures that pertain to the organization and its environment relevant to the system's emergent usage could also be inferred. Third, there is a need to have better insight into the unique characteristics of the system. This will assist in: (1) offering a richer conceptualization of the IT artifact under study, its context, purpose, and beneficiaries of its functions, (2) defining the concept of the IT artifact in a clearer and more encompassing fashion, (3) paying more attention to the materiality of the technology in question, and (4) mindfully engaging with the institutional or societal properties in theorizing the said IT artifact in the empirical situation (Orlikowski and Iacono 2001, pp 7-10). Fourth, by this

description, the nature of the extant theories (i.e., CAS and meta-design) could be conjured up and determined to be suitable for explaining the phenomenon, by employing multiple thought trials in the light of the preliminary empirical evidence now at the researcher's disposal (Ngwenyama and Nielsen 2014).

An exploratory case-study has the objective of eliciting patterns in the data that could assist in accomplishing the purposes enumerated above (Patton 1990; Stake 1994). It requires flexibility to respond to the researcher's evolving pursuit of new directions in data collection, as understanding develops during the research (Stake 1994). Thus, the research involves fieldwork where the researcher has direct and personal contact with the people involved in the natural setting of the phenomenon.

The overall research design is discussed next, starting from case-study methodology.

5.2 Case-Study Methodology

The case-study as a research strategy is well-established in IS research (Walsham 1995) and, more especially, in critical realist IS research (Williams and Karahanna 2013). Case-study research is very useful when little is known about a phenomenon (Darke et al. 1998; Walsham 1995). It is often touted as a first step in theory development, but this is not necessarily true, for case-study research can be used as a fully-fledged research strategy for theory generation (Easton 2000; Flyvbjerg 2006). Case-study research is adopted since the aim of the study is to develop a theory. Its distinctiveness as a research strategy stems from its use to understand complex social phenomena, while retaining the holistic and meaningful characteristics of real-life events existing within such phenomena (Kohlbacher 2006; Yin 2009). Also, by enabling us to pose "*what, how, and why*" questions upon a phenomenon we do not have control over, case-study research assists researchers to focus on the contemporary nature of the phenomenon within some real-life context (Benbasat et al. 1987; Williams and Karahanna 2013). In such a setting, case-study research could span from exploratory to descriptive, wherein *what* and *how* questions are posed, or an explanatory case wherein a *why* question is posed, to focus the investigation (Darke et al. 1998; Yin 2009). Often critics of case-study research focus on the lack of generalizability of its findings, but others have argued that case-study research

enables generalization from empirical data to concepts and theoretical propositions (Eisenhardt 1989; Walsham 1995).

Wynn and Williams (2012) note that there are four distinguishable aspects of critical realist case-study research when compared to positivist (Benbasat et al. 1987; Eisenhardt 1989) and interpretivist case studies (Walsham 1995). The first concerns the nature of the research questions, which must be transcendental enough to ask: What properties must exist for the phenomenon under study to occur and to be what [it] is? Or as simply put forth by Danermark et al. (2002, p. 97), “*What makes [the phenomenon under study] possible?*” This requires addressing how and why questions, which fit well with the focus of this thesis.

The second distinguishing feature of the critical realist case-study is that, before unveiling the properties that must exist for the phenomenon to happen, a description of the phenomenon is required (Easton 2000; Wynn and Williams 2012). Such a description of the phenomenon also fits with the stance in this study where this chapter is used to discuss the conduct of the exploratory case-study, and the next chapter to discuss its findings, which altogether assist in understanding the phenomenon. Easton (2000, p. 211) maintains that case-study can be “*used to describe empirical events and, by its use of multiple data sources, trace out links over time, digging ever deeper, and following through the actual to the real domain*”.

The third distinguishing feature of the critical realist case-study revolves around its generalizability. Critical realist case studies are not concerned about statistical generalization to populations (Tsang 2013). Instead, they are exclusively meant for hypothesizing causal mechanisms that seem to have generated the observed outcomes in a case (Tsang 2013). Then, the empirically identified mechanisms are generalized to the case or may be retrodictively applied to other cases in which such mechanisms are inferred to be causally active (Tsang 2013; Wynn and Williams 2012). The causal mechanisms can be generalized to the case under study, or retrodictively applied to other cases, suggesting that critical realist case studies are focused on theoretical generalization (Lee and Baskerville 2003; Tsang 2013).

The fourth distinguishing characteristic is that critical realist case studies should focus on idiographic studies of a single set of structures (e.g., an organization, a system, or events) since it is concerned with identifying the unique set of specific mechanisms that generate a specific set of outcomes (Easton 2010a; Wynn and Williams 2012). This aspect also resonates with the stance of this thesis by conducting a single case-study.

To further strengthen the appropriateness of a case-study in the research context, Yin's (1989) definition of case-study is drawn upon, which is also regarded by critical realist scholars (e.g., Aaltonen and Tempini 2014; Easton 2000) as adequate. Yin defines a case-study as "*an empirical inquiry that: investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly evident; and in which multiple sources of evidence are used*" (Yin 1989, p. 23). Yin (2009), notes the different types of case studies as being: (1) descriptive case studies that describe the main characteristics of a 'real' world situation; (2) exploratory case studies that seek to understand what happened within a phenomenon that is less well-developed; and (3) explanatory case studies that present why certain behaviors or events occurred.

Our epistemological justification for the case-study is not just because of its compatibility with critical realism's constructivist epistemological paradigm (Williams and Karahanna 2013), but also its appropriateness for exploratory and explanatory purposes of the phenomenon, using multiple sources of evidence. Particular works of scholars (e.g., Benbasat et al. 1987; Eisenhardt 1989) have provided methodological guidelines for conducting case studies for theory development. However, such studies have been critiqued as being endowed with implicit positivistic understanding and lack of ontological depth (Piekkari et al. 2009; Rasmussen 2011). Therefore, in adopting the methodological guidelines from these studies, care is needed to bring in those guidelines that are commensurable with critical realism. The works of several scholars (e.g., Easton 2010a; Williams and Karahanna 2013) have clearly demonstrated critical realism as providing the ontological, in-depth underpinning for case studies with greater potential for generating novel theories. Thus, critical realism resonates with the "*standard features of case-study*", for example, the "*emphasis on actor's accounts, reliance on*

explicit theorizing and attention to sequencing and dynamics of social processes over time” (Mills et al. 2009, p. 225). Dobson (2001a, p.238) emphasizes that “*the concept of explanation [in case-study methodology] suggests a realist approach*”, and description suggests more of an “*interpretive approach*”. However, Neuman (1997, p. 20) notes that their distinctions “*blur together in practice*”, for it is not always easy to decisively separate them, as explanatory research builds “*on exploratory research*”. Thus, case-study can combine analytical, explanatory/theoretical, and ontological frameworks together for investigating a specific phenomenon. Such a combination provides insights that will assist in developing an explanatory theory that mirrors the answers to the research questions.

5.2.1 Rationale for Selecting Single Case-Study

Case-study research can either be a single case-study or a multiple case-study (Easton 2000). A single case-study for theory development was chosen, as noted earlier. The aim of developing theory from a single case-study will be a theory that is not abstracted from the case, but rather a theory of the case itself that explains it (Easton 2010a; Tsang 2013). Schofield (2002) classifies this type of single case-study as a “*what could be*” case-study, which is also corroborated in IS literature (e.g., Sarker et al. 2012; Silva and Hirschheim 2007). Such a case-study allows us to develop a deep understanding of systems-in-use in their socially embedded contexts (Orlikowski and Iacono 2001) and of design actions related to its use (Hovorka and Germonprez 2008; Iivari et al. 2010). Schofield (2002, p. 217) maintains that “[b]y studying ‘*what could be*’, I mean locating a situation that we know or expect to be ideal or exceptional on some a priori basis and then studying . . . [it] to see what is actually going on there”. Findings from “*what could be*” case-study research are not only generalizable to the theory that explains the situation, but also can be generalized across cases that are substantially similar, because we are dealing with open systems (Easton 2010b; Schofield 2002).

A single case based on its extreme nature was identified and selected by drawing from Schofield’s (2002) concept of “*what could be*”. Schofield’s (2002) concept of “*what could be*” also relates to Yin’s (2009) single case extreme and unique conditions, which Sobh and Perry (2006) confirm as being enough to justify single

case critical realist research. The case is extreme in nature in the sense that the event under study, (that of emergent usage behavior), represents a condition that yields a potentially rich source of insight that somehow allows it to deviate from a more general case, a state that other similar cases might wish to achieve.

Particularized to this study on emergent usage behavior, the case *uniqueness* stems from the fact that most research on IS use in individual contexts has assumed the IT artifact to be static and passive, with few studies investigating individual emergent usage of adaptive IS (Straub and del Giudice 2012). Where individual adaptation of IS has been researched (e.g., Barki et al. 2007), studies often ignore the influence of the co-evolution of the flexible structures of IS and that of users' interaction, or they do not capture the design activities related to its use (Fischer 2010a; Hovorka and Germonprez 2008). To capture such co-evolution demands the blurring of the boundaries between design time and use time. The idea that software design is completed-in-use no longer holds in most new breed web-based adaptive systems, due to their evolving nature (Fischer 2010a; Germonprez et al. 2011). Consequently, the case-study is uniquely positioned for this kind of research situation, as it epitomizes an open IS phenomena with emergent properties. Here, individual users are experts in their own world and are encouraged to choose what and how to represent such a world, based on what the IS affords (Volkoff and Strong 2013).

Our case-study's *unusualness* stems from the fact that the researcher had access to investigate the design of a software artifact in the case organization, as well as its usage, that was strongly tied to its design (i.e., design-in-use). This provided access to a phenomenon that previously seemed inaccessible to scientific investigation (Seidel et al. 2013; Silva and Hirschheim 2007). The researcher was especially involved in collecting users' feedback, which was incorporated into the re-scripting of the system to keep it in a *perpetual beta version*, by reason of its evolutionary growth, while-in-use (Fischer 2013; Hagen and Robertson 2010).

The researcher argues that the emergent usage behavior with this kind of system is not new in the context of e-financial services, but this phenomenon is rarely studied in its natural environment. In order to investigate the causal processes that have produced the emergent usage of adaptive IS, the material and social structures

generating the events should be known in both design and use time. In design and design-in-use process research, researchers rarely have access to an environment that could enable them to simultaneously investigate both the design and the design-in-use. IS adoption studies that only focus on IS use without due consideration of its structures, specific contextual conditions in design time and use time, are limited (Fischer 2010a; Leonardi and Barley 2008; Zhang et al. 2009). Such a limitation exists because the “*dispositions, capacities, and potentials of [the software artifact] to do certain things, but not others which may or may not be activated depending on the specific contextual conditions*” (Wynn and Williams 2008, p. 6). The contextual conditions are made evident when we simultaneously consider both the design time and the corresponding use time of a system (Leonardi and Barley 2008).

Studies on this kind of IS phenomenon tend to develop prototype systems in laboratories for experimental studies. However, the researcher argues that such studies are relatively powerless to explain how the system is appropriated-in-use, due to the contextual conditions that strongly impact on its usage, which are external to the software artifact and made evident at use time (Heyer and Brereton 2010). As such, traditional design researchers are often forced to evoke imagination about emergent usage that does not yield depth of data in context (Heyer and Brereton 2010). In contrast, this study involved investigating a ‘real’ system in its natural context. Thus, a single case that at least approximated a theoretical ideal situation was chosen, with the goal not to generalize to other cases but to uncover what could be and under what conditions.

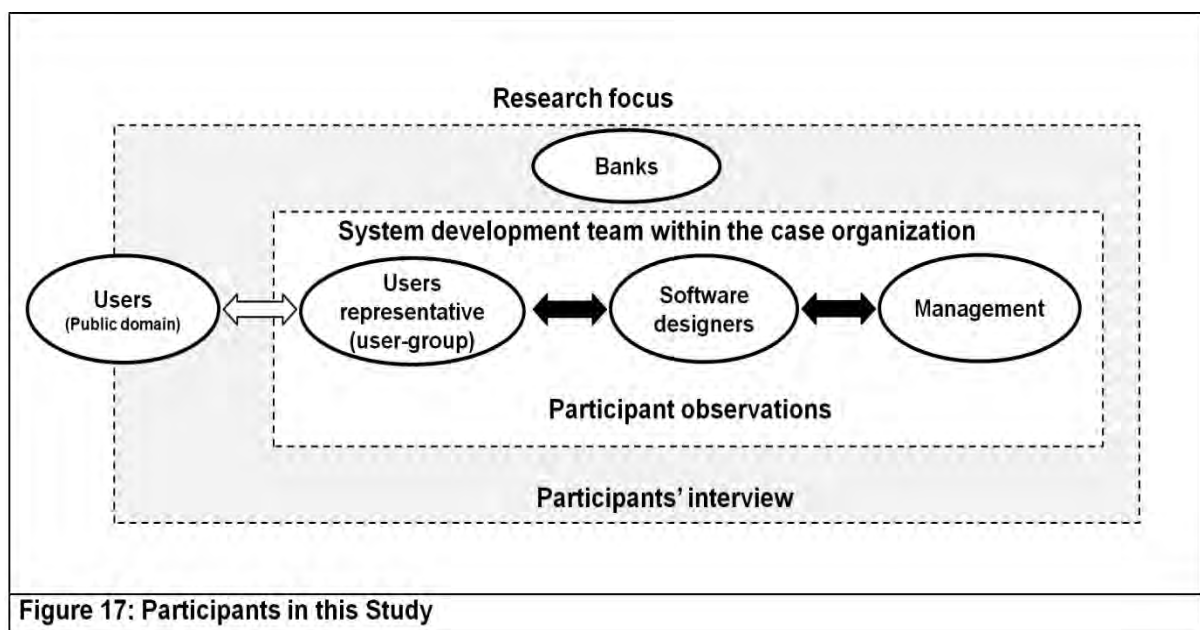
The single case-study of “*what could be*” is also highly compatible with critical realism (Easton 2000, 2010a; Walsham 1995). The critical realist’s “*what could be case-study*” identifies the distinct event(s) that captures the effects of the context, structure, and individual influences (Wynn and Williams 2008). Such an identification of events enables the development of context-sensitive causal explanations of the specific phenomena, by starting from such effects and retroducting backward, to identify what must have caused them (Easton 2010a; Wynn and Williams 2008). Easton (2010a) argues that critical realism requires case-study research to answer questions about *what could be* in the form of “*What caused the events associated with the phenomenon to occur?*” (Easton 2010a, p. 123). As such,

the researcher focused on what has happened, i.e., user experiences of the emergent IS usage events that are observable and empirically verifiable, and the underlying mechanisms that could have caused the particular event to have happened. The interplay between the observable experiences, behaviors, and the underlying mechanisms epitomizes the *stratified ontology* of basic critical realism and the concept of *retroduction strategy*. Case-study research is hence posed as an appropriate methodology to answer the research questions. Table 11 further enumerates the relevant characteristics of the case-study approach for this study.

Table 11: Other Relevant Characteristics of a Case-Study Approach	
Other Characteristics of Case-Study	As Relevant to the Thesis Critical Realist Single Case-Study
“... method that involves investigating one or a small number of social entities or situations. . .” (Easton 2010a, p. 119)	The single social entity is the adaptive IS for e-financial services. Its survival depends on the adaptive activities of human agents with many observable experiences. Such experiences are congruent with critical realist ‘empirical’ domain of reality
Reveals a particular event in a real life context (Easton 2000; Eisenhardt 1989). Case description and analysis should focus on event(s) (Easton 2000)	The case here is the emergent usage of adaptive IS for e-financial services as the real life context. The exploratory case-study and its findings in the form of case description and analysis in Chapters 5 and 6 of this thesis is in conformity with stage 1 of Danermark et al.’s (2002) realist model
Use multiple sources of evidence (Easton 2000; Tsang 2013; Wynn and Williams 2008; Yin 2009)	Critical realist case-study approach of this thesis endorses data, theories and methodologies triangulations
Engage in general analytic strategy of relying on theoretical proposition and scrutinizing rival theories with the aim of selecting the theory that explains the result better (Yin 2009, 2011)	Theoretical redescription is carried out using pre-existing socio-technical theories with significant explanatory power. Such theories were selected on the basis of initial empirical evidence and subjecting rival theories to immanent critique. Fulfillment of stage 3 of Danermark et al.’s (2002) realist explanatory model
Case event is looked at in depth or “ <i>digging ever deeper, and following through the actual to the real domain</i> ” (Easton 2000, p. 211)	Congruence with the study for it enables the researcher to understand the experiential factors at the empirical domain. After that, the case research is extended by unveiling the underlying causal mechanisms in the real domain via retroduction process. Fulfillment of stage 4 of Danermark et al.’s (2002) realist explanatory model
Addresses the ‘how’ and ‘why’ questions (Benbasat et al. 1987; Darke et al. 1998; Yin 2009) “... case-study research is useful as a means of studying information systems development, implementation and usage in the field...” (Darke et al. 1998, p. 274)	Congruence with the study’s central question: <i>Why do emergent usages occur in adaptive information systems?</i> Also, the researcher investigates an adaptive IS for e-financial services where development, implementation and usage time is blurred by reason of design-in-use to warrant emergent usage. Thus, case-study is appropriate for this kind of phenomenon

5.2.2 Establishing the Case, Unit of Analysis, and Site Selection

Since the aim is to achieve theory retrodiction (i.e., a theory that explains what has happened or is happening) (Bhaskar 2008b; Fleetwood 2002), or explanatory theory of the problem (Markus 2014), events are considered as our case in critical realism (Wynn and Williams 2012). A case is an instance of an event or events that coalesce to form a researchable phenomenon (Easton 2000, 2010a; Yin 2011) in a bounded social context (Anderson et al. 2005; Miles and Huberman 1994). Events are “*not as discreet or themselves singular, but [are] . . . embedded in overlapping sets of processes over time*” (Ryan et al. 2012, p. 306). Figure 17 illustrates the occurrence of the events under investigation and sets the boundaries of the case. Since the emergent usage of adaptive IS cannot occur without the original design supporting the notion of new purposes of use, the design activities are also included, as illustrated in Figure 17.



As Figure 17 attests, it is obvious that the research has an embedded unit of analysis (Miles and Huberman 1994; Paré 2004; Yin 2009). The case (i.e., emergent usage of adaptive IS for e-financial services) is the primary unit of analysis within this single case; however, attention is also given to the social actors' experiences, perceptions, apperceptions, and actions in the technology as sub-units (Miles and Huberman 1994; Paré 2004). The social actors' experiences, perceptions, apperceptions, and

actions provide cues of what seem to have caused the emergent usage of the technology to occur over a period of time. The social actors are the managers and software designers in the case organization, as well as officers of banks and ‘prosumers’ or active users outside the organizational context (Fischer and Herrmann 2011; Tapscott and Williams 2006). In their respective constituencies, these actors make up the interdependent elements that create the emergent IS usage event, by reason of their interactions (Anderson et al. 2005; Fischer and Herrmann 2011). Thus, *“valuable insights can be gleaned by studying the behavior that occurs at and across the boundaries that [seem] to define the case”* (Anderson et al. 2005, p. 674). The unit of analysis also sets the operational boundaries of the theory that is about to be developed and it clearly and directly associates with the research questions (Paré 2004; Yin 2009).

5.2.3 The Case Organization

Through a purposive search, 22seven was chosen as the case organization (Stake 1994; Yin 2009). A detailed description of the case organization was one of the main purposes for conducting this exploratory case-study as is explicated in the next chapter. The case organization defines the boundary of the case and moves beyond the initial boundary of being a social context to capture other structural conditions (Anderson et al. 2005; Mills et al. 2010). It was selected based on the uniqueness of the case as earlier discussed in justifying a single case-study. *“[T]he factors that dictate a single case design also determine site selection”* (Benbasat et al. 1987, p. 373).

The case selection was further strengthened by the combination of field-determined decisions. The phenomenon was matched with the synthesized conceptual framework, wherein the case organization fitted both the purpose of research and the phenomenon of inquiry (Darke et al. 1998; Ragin 2004; Schofield 2002). The following three reasons further underpinned the selection. Firstly, 22seven is arguably successful in deploying a disruptive e-financial system, the first of its kind in South Africa, where users can customize financial services to meet their varied needs in their context-of-use. Secondly, the transformation efforts of the technology span across the originating organization, individuals, banks, and society, with efforts

to redefine the concept of use when it comes to e-financial service-systems. Thirdly, the case organization designs and maintains the technology with specific users that can be identified while-in-use, hence cycles of use and redesign are obvious and empirically verifiable since it is tightly linked to users' feedback. As such, the researcher was able to examine the activities of both the designers and the users. Besides, the relative ease in tracing the ongoing cycles of design, use, and modification in a longitudinal manner within and out of the case organization provided a strong strategy for identifying the underlying mechanisms and experiences of users (Leonardi and Barley 2008).

5.2.4 Negotiating Entry

Access to the case organization is so important that there is no way this research would have been possible without gaining the organization's approval (Walsham 1995, 2006). The researcher met one of the senior managers of the case organization at a postgraduate students' social gathering. The senior manager happened to be an executive MBA student of the University of Cape Town (UCT). Briefly, the content of the research was discussed and the assistance of the manager was also solicited in order to gain entrance to the case organization. Thence, the senior manager advised the researcher to email the chief business analyst/operations, who had by now assumed the role of the researcher's contact person for gaining entrance into the organization. The reasons for the research, the researcher's role, and the duration of the research were detailed in the email. Other details included the strict adherence to confidentiality in research practice, the potential benefits to the case organization, and their level of involvement. By late 2012, the researcher received an email, after a series of follow-ups, for a visit to the organization. He was introduced as a doctoral student to the development teams by the top management during the first visit. His request to take a participatory role by joining the internal user-group in exchange for rich research data gathering was also granted.

5.2.5 Role of the Researcher

Critical realist researchers are not only attempting to access *“people's interpretations [that are embedded in their details of experience], filtering them through their own*

conceptual apparatus or [their construction of meanings]" (Walsham 1995, p. 77), but also their motives and perspectives, i.e., the presuppositions on which such interpretations and meanings rely, who produced it, for whom, and why (Carlsson 2012). In carrying out this work, the researchers' role spans across two extreme poles of "*covert*" and "*overt*" involvement during data collection (Adler and Adler 1987, p. 13; Walsham 2006). The overt role is where the researcher participates fully with the group under study, and who have earlier been briefed about the conduct of the research. The *covert* role is where the researcher deliberately conceals from the group the research dimensions of his/her participation (Bøllingtoft 2007). In this research, overt style is adopted as the researcher engaged in participant observations, semi-structured interviews, and document analysis. The efficacy of the overt style gradually evolves from "*the getting in, staying in, . . . [and] easing out of the site*" (Laws and McLeod 2004, p. 12).

Being an embedded researcher in the context, because of the existing personal ties to the user community, the researcher armed himself with the conceptual framework considered here as non-deterministic, observing notable changes in the theoretical orientations (Siggelkow 2007). Thus, the realities were aligned on the basis of what was met at the data collection site which effected some theoretical changes in the setting during the research itself (Heyer and Brereton 2010; Laws and McLeod 2004). The researcher underwent changes organically from overt role-player to shadowing, creating new opportunistic roles and, in the engagement of inner reflections, collating data within the setting as they emerged (Adler and Adler 1987; Laws and McLeod 2004). Being part of the user group that facilitated the IS use, the multiple roles of the researcher in the site also strengthened the participants' understanding that the researcher was making valid contributions to the survival of the system; this encouraged their motivations to participate (Walsham 2006).

The researcher was aware of the risk of 'going native', or of participants shifting their attention to the research project itself rather than practicing their natural behavior, as well as the influences of the researcher's bias (Bøllingtoft 2007; Walsham 2006). However, various strategies were put in place to mitigate such risks as the data collection was carried out. This is discussed in the data collection section.

5.2.7 Participant Sampling and Saturation

Sampling is the process of selecting a portion that is representative of a whole, wherein the said portion selected becomes the proper source for data collections and analysis (Marton 2013; Onwuegbuzie and Collins 2007). Sampling informs the quality of inferences made by researchers, addresses the quality of research, and it logically links research questions with data elicitation and analysis (Marton 2013). Consequently, choosing a sample of participants for data gathering is a key feature of any research project (Layder 1998). In a case-study, snowball and/or purposeful sampling techniques are used in the selection of specific participants (Flyvbjerg 2006). Such a selection is also the case with a critical realist intensive design (Iosifides 2011; Yeung 1997), in order to maximize understanding of the underlying phenomenon (Iosifides 2011; Onwuegbuzie and Collins 2007). Thus, purposeful and snowball samplings were used to select a wide variety of participants. Such participants had both corroborative and discordant tones that denote knowledgeability in the very context of this research. Also, since the investigation is driven by theorization, the chosen sampling techniques help in: (1) avoiding the de-contextualization of the object of research, and (2) the valid choice of participants that could provide meaningful discourse (Iosifides 2011). Extra care was taken to recruit participants to ensure maximum variation, including those who used the system and others who had discontinued or resisted the system, in order to cover the heterogeneity and differentiation that seemed to characterize the events (Iosifides 2011).

Table 12 below illustrates the participants who were interviewed. They include managers, software designers in the case organization, bank officials, and actual users who are self-directed knowledge workers.

Table 12: Data Sources for the Research					
Phase 1: Data Sources					
Participants observations		30days	2 Nov. 2012 - 24 May 2013 13 February 2014 - 28 February 2014		
Interview Participants					
#ID	Name	Occupation	Access Devices to the System	Time Frame	
Management of 22seven				2 Nov. 2012 - 24 May 2013	
M1	Paul	CEO/IT director	Desktop, iPhone, iPad		
M2	Andy	Chief Business analyst/operations	Desktop, iPhone, iPad, Samsung Tablet		
M3	Camel	Chief technical architect	Desktop, iPhone, iPad		
Software Designers in 22seven					
SD1	Stone	Software Designer	Desktop, iPhone, iPad		
SD2	Hawking	Software Designer	Desktop, Samsung Smartphone, Tablet		
SD3	Andrew	Software Designer	Desktop, iPhone, iPad		
SD4	Davallu	Software Designer	Desktop, Samsung Smartphone, Tablet		
SD5	Ravi	Software Designer	Desktop, iPhone, iPad		
Individual Users					
U1	Annabel	Retail Manager	iPad		
U2	Gugu	Health Worker	Nokia Smartphone		
U3	Cathy	Senior Retail Officer	iPhone		
U4	Mike	Senior Retail Officer	iPhone		
U5	Patty	Tax Consultant	iPad		
U6	Atidaishe	Entrepreneur – Restaurant	iPad, iPhone		
U7	Bongani	Web Designer	Samsung Tablet		
U8	Moses	Journalist	iPhone		
U9	Moeketsi	Marketing Consultant	iPad		
U10	Rebecca	Customer Service Manager	iPad		
U11	Oliver	Logistics Manager	iPad, iPhone		
U12	Theo	Warehouse Manager	iPhone		
U13	John	University Lecturer	Samsung Tablet		
U14	Peter	Business Contractor	iPad		
U15	Bezile	Finance Director	Samsung Smartphone, Samsung Tablet		
U16	Aizivaishe	Entrepreneur – Media & Film	iPad, iPhone		
U17	Bandile	Web Designer	iPad		
U18	Frank	Stockbroker	iPad		
U19	Avila	Child Psychologist	Samsung Tablet		
U20	Nick	Bank Manager	iPad		
U21	Ayanda	IT manager in a bank	iPad, iPhone		
U22	Khathutshelo	System Admin	iPad		
U23	Jeremia	Entrepreneur – Comedian-artist	iPhone		
U24	Riccardo	Postgraduate Student	Samsung Smartphone		
U25	Tom	Health worker	iPad		
U26	Whitney	Social worker	iPad		
U27	Brown	Financial Consultant	iPad		
U28	Alex	Insurance	Samsung Tablet		
U29	James	Entrepreneur – Car dealer	iPad		
U30	Karl	Sea Man-ship	Samsung Tablet		
Blogs			13 February 2014 - 28 February 2014		
Corporate Press Releases			2 Nov. 2012 - 24 May 2013 13 February 2014 - 28 February 2014		
Photographs			2 Nov. 2012 - 24 May 2013		
Memos			2 Nov. 2012 - 24 May 2013 13 February 2014 - 28 February 2014		
Phase 2: Data Sources					
Participants observations		10days	13 February 2014 - 28 April 2014		
Interview Participants					
Software designers and individual Users: the same as in Phase One			13 February 2014 - 28 April 2014		

Knowledge workers in this context are defined as those people who have taken responsibility for their work lives, either through entrepreneurship or through paid work that involves significant time (Gurteen 2006; Sellen et al. 2002). They continually strive to understand the world about them and modify their work practices and behaviors to better meet their personal and organizational objectives. A survey by Sellen et al. (2002) reveal that knowledge workers are highly interactive, innovative, and evaluative of e-commerce websites, with a goal-directed focus. In the South African context, such knowledge workers typically live in urban centers that reflect South Africa's 'first economy', a term used to characterize many developed world economies. South Africa's 'second economy' is characteristic of many least developed and emerging economies (Brown et al. 2007). First economy knowledge workers possess the requisite skills, prior and ongoing usage experience, cognitive structures, and viable or affluent incomes to drive emergent usage of the e-financial services innovation (Sellen et al. 2002). The focus is on knowledge workers in South Africa who are online customers of one bank or the other, with the likelihood of opting for the e-financial service-system. Thus, by purposeful and snowball sampling, these digitally savvy knowledge workers were identified. They, in turn, introduced the researcher to other similar people (Miles and Huberman 1994, p. 28).

Numbers of participants are known to be small in critical realist case-study or qualitative research, in order to focus on depth rather than on breadth (Iosifides 2011; Miles and Huberman 1994), but there is no consensus of the exact numbers needed, according to IS literature (Marshall et al. 2013). Miles and Huberman (1994, p. 27) argue for the focus on a small number of people "*nested in their context and studied in-depth*", while Marshall et al. (2013) suggest at least 30 participants for a single case-study IS research. Despite being sensitized by some kind of guidelines for qualitative sample sizes from these scholars (e.g., Marshall et al. 2013), the sampling adequacy shown in Table 12 was carefully thought out. It was not too large as to be repetitious – which introduces difficulty in extracting themes, since more data does not necessarily lead to more information (Mason 2010; O'Reilly and Parker 2013). At the same time, the sample size was not too small, leading to a lack of data saturation (Bowen 2008; Mason 2010; Morse 1995). Sampling of participants continued to evolve as the research progressed from **Phase 1** to **Phase 2** of the research design.

While saturation is helpful in determining sample size, there are no standard tests for estimating or proving adequacy of sample size for reaching saturation (Mason 2010; O'Reilly and Parker 2013). Also, the very point of saturation is impossible to notice, therefore it is difficult to identify a particular moment when data collection should cease (Mason 2010). Rather, the researcher got to a point in the analysis of data where the descriptive evidence in the case of Phase 1 and themes generated in the case of Phases 1 and 2 appeared to be well developed and fully accounted for, in the light of the research model and aims (Braun and Clarke 2006; Layder 1998; Morse 1995). Collection of extra data, at this point, becomes “*counterproductive as the new . . . [being] discovered does not necessarily add anything to the . . . [descriptive evidences or themes already generated]*” (Strauss and Corbin 1998, p. 136). Stretching the data collection further by sampling more participants offers the potential for ‘the new’ to emerge, but it becomes counterproductive if ‘the new’ that emerges continuously finds itself attracted to one of the distinct themes/categories or the descriptive evidences already developed. As such, it is important at this stage to cut off the data collection (Francis et al. 2010; O'Reilly and Parker 2013). Table 12 reflects the number of participants which are indicative of data saturation. Names have been changed to protect participant anonymity.

Since the aim was to ensure information-richness from the case under study (Layder 1998), the process of achieving saturation for sampling adequacy was not only based on the number of participants, but also on the quality of the data and the “*combined force of our prior theoretical ideas . . . and analysis of data in relation to them*” (Layder 1998, p. 47).

To increase the quality and power of data from the sample, each participant was seen as one episodic observation unit. Each was subject to re-visitation to elicit their mental contents as their experience with the technology accumulated. Before closing the interview in both phases of data collection, the researcher gave the participants the opportunity to challenge (McDaniel et al. 2009) or add any extra information they believed was significant, by asking whether there was anything else the participants wished to add or clarify (Sobh and Perry 2006).

Having now discussed the overall case-study research design, the next section will focus on the exploratory case-study sources of data and data collection activities.

5.3 Critical Realist Exploratory Case-Study

5.3.1 Preliminary Sources of Data and Data Collection Activities

Data collection followed a longitudinal approach in this phase. It involved the key participants in both the design and the use of the system, as shown in Figure 17 and in Table 12. The longitudinal approach enabled experiences to be charted through long-term use of the system. It also captured the dynamic responses and changing apperceptions of users over time (Karapanos 2013). In this case, the system was relatively new, although enough time had passed to allow the system to record emergent usage historicity of experiences from both the designers and users (Karapanos 2013). The historicity of experiences from both the designers and users is also reflected in the time frame of the interview, which was uneven and in correlation with the time the events occurred. At each phase of the research, participants validated the transcribed interviews and preliminary findings. Data collection was aimed at collecting multiple forms of data; this included participant observation, interviews, and photography as primary sources, with documentary evidence, blogs and press releases as secondary sources.

5.3.2 Participant Observation

Participant observation placed researchers in a vintage position to see activities and behaviors as they occurred, rather than relying solely on accounts from interviews. This method is particularly useful when the phenomenon is less understood and when participants are unable or unwilling to be interviewed, or when human interactions are of interest (Bøllingtoft 2007; Merriam 1988). *“By participant observation, we mean that method in which the observer participates in the daily life of the people under study, either openly in the role of researcher or covertly in some disguised role, observing things that happen, listening to what is said, and questioning people, over some length of time”* (Becker and Geer 1957, p. 28).

There are two types of participant observation – the structured and the unstructured (Bøllingtoft 2007; Robson 2002). The unstructured version “*allows the observer considerable freedom in dealing with the information gathered and how it is recorded, since there are no predetermined categories*”, while the structured observation is guided by predetermined theory or categories (Bøllingtoft 2007, p. 142). The researcher adopted the unstructured version to gain insights into the social process of developing the software artifact which was not a one-time affair, but continued to evolve as users appropriated the system. The researcher was thus able to observe the design-in-use processes (Fischer 2008).

In the organization, participant’ observation began with a broad scope that was unfocused, a situation Bøllingtoft (2007, p. 422) classifies as descriptive observation, since it is difficult to know what is important in the initial stage. The descriptive observation provided a base from which selective observation was captured in the research agenda (Bøllingtoft 2007; Spradley 1980). The researcher participated in the software-shaping workshops that the case organization regularly organized to further strengthen user-designer collaboration. It was natural for the researcher to intensively observe the daily work activities of the designer teams, since the emergent usage of the technology is primarily dependent on what is designed and how it is designed (Carlsson 2006; Hovorka and Germonprez 2008; Iivari et al. 2010). Such workshops empower designers to shape user environments by allowing the *owners of problems* to be in charge of the application (Costabile et al. 2007). It also allowed the researcher to witness designers-user interactions.

Researcher involvement may vary from complete participation to complete observation. In complete observation, the researcher remains detached from the group, while in complete participation or what Robson (2002, p. 534) calls “*the practitioner-researcher role*”, the researcher becomes an active member of the group being studied (Bøllingtoft 2007; Merriam 1988). In this study, complete participation, which also captures the overt role of the researcher, was adopted (Adler and Adler 1987). This allows data gathering activities of the researcher to be sandwiched with his/her duties as part of the internal user-group in the organization. As a member of the internal user-group, the researcher liaised with the actual users in the public to extract their experiences and future needs via Skype, phones, and

click-to-chat features of the website; this knowledge was then passed on to the software designers as user stories on a weekly basis. The researcher's role in the case organization provided an excellent way of minimizing researcher bias as in:

- 1) creating *minimal interaction* with the observed, for the designers tend to relate to the researcher more in his duties than in his research role. This lessened the apprehensiveness of the researcher's presence on the observed (Robson 2002; Yin 2009);
- 2) creating *trust and habituation* of the designer teams to the observer's presence, wherein members of the team appeared to accept the researcher (Robson 2002);
- 3) avoiding *selective attention*, since the researcher's duties availed him the opportunity to engage with all the team members and the top management (Robson 2002).

Another consideration is to determine what to observe in the field. Several cues or actions are suggested by Merriam (1988) as to what is to be observed. This includes office setting, participants' activities and interactions, frequency and duration of tasks, and subtle actions or cues, for example, connotative meanings of words, informal activities, and nonverbal communication. In this study, the physical office settings, managers, designers, and user group's activities and interactions were observed. Other subtle aspects observed included the use of work-related terms, nonverbal communication, and unusual activities or events such as when the functioning system or a section of its features failed due to bugs.

To note the observation, the researcher selected which activities were to be jotted down in field notes, since not all observed activities counted. Thus, the transformation of the activities as they unfolded in the researcher's notebook was immediate and guided by the quest to say "YES" to this question: "*Do these activities, of the designer teams or the management, currently under observation, influence the adaptive usage of the web portal out there?*" A laptop installed with Nvivo (QSR10) was used as the virtual notebook. Nvivo (QSR10) is a type of qualitative data analysis software (QDAS). Here, all the daily field notes within the 30 days stay in the case organization's office hours, were saved as memo files, including photographs to minimize loss of information due to memory recall. This

helped in organizing the data and offered the flexibility that is needed to complement data analysis. More memos were also created to capture several meetings attended, such as the stand-up meetings with designers, management meetings, and user group meetings, on a weekly basis.

Despite the usefulness of participant observation, it is saddled with limitations. It is highly subjective due to the unreliability of human perception. It confines the researcher to only observe external behaviors and actions of participants (Merriam 1988; Patton 1990). One strategy used in this study to reduce the effects of such limitations was to engage in episodic observations to note varying conditions (Adler and Adler 1987). By doing this, data could be searched for concordance and discordance findings at different times during the process, as shown in Table 12. Moreover, observations that seem correct or doubtful can be reconfirmed or straightened out through interview questions.

5.3.3 Interview

Interviews were used to determine what was on participants' minds, especially when their usage experiences, behaviors, feelings, attitudes, or interpretations of the technology could not be directly observed (Merriam 1988; Patton 1990). Interviews also served to validate participant observations with their perceptions of the same events observed. Interviews vary in types from structured to unstructured or open-interview. Structured interviews allow researchers to, in an orderly manner, ask the same questions, in order to obtain comparable information. In contrast, unstructured interviews are more spontaneous, open, and occur from a natural flow of interaction between interviewer and interviewees (Merriam 1988).

This study utilized open semi-structured interviews, adapted to reflect the participants' engagement with the system. The semi-structured interview allows for the possibility of greater flexibility; this allowed new questions to emerge and reemerge with in-depth conversation between participants and the interviewer. Questions for the interviews (see Appendix C) were derived to align with: (1) the purposes of the exploratory case-study, (2) participants' interaction with the system, (3) the research questions, and (4) literature concerning emergent usage of IS. To

ensure that the information was accurate and complete, an mp3 digital tape recorder was used during the face-to-face interviews that each lasted for between 45 and 90 minutes; backup notes were taken as well. Managers, software designers, and the members of the in-house user-group were interviewed in a separate office during the participant observation period. Their respective interview questions, office location, and consent forms were emailed to the participants a week ahead of the time schedule. Some participants opted for a change of days and the time allocated, with which the researcher obliged.

The actual users of the technology were interviewed in their respective offices during their office break hours or at coffee shops, as dictated by them, while officers of the banks were in their offices, as arranged by them. The actual users of the technology and officers of banks were identified by referrals from the case organization, considering banks' proclivity for silence and the confidentiality attached to money matters in the case of the actual users. By such referrals, the researcher met each interviewee as both a staff member of the case organization and as a researcher. Though rare to secure, such referrals built a high level of trust for the interviews to happen (Bygstad and Munkvold 2011a). There were no gifts or monetary incentives for the interviewees were all experts in their respective endeavors and were motivated participants who not only had the *"insights into . . . [the] matter, but also [could] suggest sources of corroboratory or contrary sources of evidence . . . and initiate access to such sources* (Yin 2009, p. 106). An actual user during the interview commented:

You should probably use me as a case study for your service. I manage three check accounts and three credit cards using your service so I am getting a lot of experiences using 22seven. Thus far, my only main request is that you increase the number of category's tagging to enable me customize other contents. I believe this part of your service is the most powerful. My reservation of your service is hackers could plunge into your website and this made my friend to de-list your service, but for me life is a risk generally. (#U29)

The participants were asked to complete a consent form, in accordance with the UCT Ethics in Research Committee's practice guidelines. They were encouraged to seek any necessary further clarification before signing the consent form, as shown in Appendix B.

The researcher first presented to the participants the objective of the case-study interview and how the data from the interview would be used.

Good quality data from interviews is highly dependent upon the skills of the interviewer and the participant. Interview protocols, that endorse starting with a simple descriptive question that will allow the interviewer and interviewees to acclimatize to playing their roles, were followed. Such question allowed the interviewees to speak about their motivation and skills when combined with data gathered in later questions. After the introduction, the participants, one at a time, were interviewed with their respective interview questions; there was a move towards more specific questions that were reflexively gleaned from the previous conversations. Before exiting, the trust and rapport seen to exist were capitalized on to request for referrals from the interviewees. As exemplified by the above interviewee's comments (#U29), his colleague who had de-listed from the technology, citing security reasons, was referred to the researcher. By triangulating participants observation and interviews, matters that could be observed were noted; those that could not be directly observed were followed up with interviews, to increase the validity of the empirical research (Runeson and Höst 2009; Wynn and Williams 2012). Taylor and Bogdan (1984) maintain that no other method *"can provide the detailed understanding that comes from directly observing people and listening to what they have to say at the scene"* (p. 79).

Interviews, as any other form of data collection, have limitations such as subjectivity, possibility of obtaining false or misleading data, biases of both interviewer and interviewee, and the possibility of witnessing interviewees' reticence (Merriam 1988; Spradley 1979). Careful selection of interviewees and relevant questions, refraining from arguments, adopting a reflective listener's position, and being sensitive to verbal and nonverbal messages were used to minimize these limitations (Merriam 1988; Spradley 1979). To reduce distortions of data as well, the researcher allowed the interview to flow and only spoke to seek for clarification or further elaboration.

5.3.4 Documentary Evidence

Yin (2009) notes that documentary information *“is likely to be relevant to every case-study topic”* (p. 101). Further to Yin’s (2009) comments, Merriam (1988) claims that *“documents of all types can help the researcher uncover meaning, develop understanding, and discover insights relevant to the research problem”* (p.118). Consequently, six repositories for sources of documents were sought in the case organization for this research:

1. Public documents such as statistics of South Africa, South African Reserve Bank gazettes, and the local banks’ gazettes;
2. Industry studies on the South African e-financial sector;
3. Documentation about the organization’s formation, investors and organization structure, business models, partners’ alliances, and historical antecedents that preceded the launch of the application;
4. Documents containing minutes of meetings and work activities of managers and software designers, materials distributed at various management meetings, and presentation materials, including other materials distributed via electronic mail;
5. Users’ log files and user activity reports that were printed daily to analyse the system behaviors by designers and to spot security breaches, if any;
6. Documentation related to the software architecture, development methodologies, and other documents and procedures in the case organization.

These sources provided highly credible data related to administrative, organizational, and institutional aspects associated with:

- the South African e-financial environment,
- staff matters and work activities,
- the organization’s business model,
- systems development and usage,
- dates of events and what happened,
- records of meetings and activities of various teams,

- works directly or indirectly associated with the initiation, development, and deployment of the technology to the South African e-financial ecosystem,
- maintenance and continuous improvement of the system.

The researcher complemented these documents with press releases in print and social media, and blog posts published on both external website and 22seven.com. External blog websites, for example, <http://bankmonitorsa.blogspot.com/> provided regular commentaries on mobile apps in financial services, especially in South Africa. Their contents were downloaded on the topic relevant to the research agenda and saved as memo files in Nvivo.

Just as with other methods, document analysis has limitations. The researcher is an outsider with little or no context for understanding the case. Thus, the main limitation is the challenge of connecting the pieces of information together to make a description of the case (Evanciew and Rojewski 1999; Lincoln and Guba 1985). However, to overcome such a limitation, questions were asked to seek for further clarification on any unclear items in the documents. Its limitations notwithstanding, *“documents analysis provide a valuable and readily available source of information. They are a stable source of information since the researcher’s presence does not alter the information contained in the documents”* (Evanciew and Rojewski 1999, p. 7).

Data collection was complete when all data sources relevant to the research agenda were exhausted, and when any other extra information gathering was counterproductive. Saturation of categories is evident through the emergence of regularities in the data pattern (Lincoln and Guba 1985). Specifically, the data collection came to a conclusion when the researcher *“began to hear and see commonalities, recurrences, and redundancies in the data”* (Evanciew and Rojewski 1999, p. 7). Upon completion of the data collection, the data were organized in preparation for case-study intensive data analysis (Merriam 1988).

5.4 Summary of Data Collection for the Exploratory Case-Study

The three data collection techniques offered complementary perspectives for exploring, discovering, and describing events, activities, forces, and the contexts that shaped the system's development and its emergent usage. Each technique collected different types of data, each of which had special utility for the research. A primary concern of the data collection was to develop a data repository, upon which the researcher could describe the case, explicate events, and also answer the research questions, since the data were highly relevant for Phase 2 of the explanatory study discussed in Chapter 8.

Table 13 below summarizes the sources of data and the utility of each type of data specifically meant to explicate the events, in fulfillment of stage 1 of Danermark et al.'s (2002) model. The multi-method approach of data collection maximized the range of information available to the researcher, improved the data's trustworthiness, and provided a basis for triangulation between data sources.

Table 13: Type and Utility of Data from Each Data Collection Activity in Phase 1			
Data Source	Type of Data	Utility of Data	Purpose
Participant observation	• Textual data in the form of: researcher's field notes, observations and experience of managers, designers, and user-group • Events, activities, and process occurring in the case organization associated with the emergent usage of the technology	• Provided researcher with experience of IS development and emergent usage in the natural context of the people involved	• Assisted in collecting descriptive details about the continuous system development to support user requirement changes while-in-use • Interpret and understand the data collected in the semi-structured interviews
Semi-structured interviews	• Textual data in the form of: participants' experiences, apperceptions and actions in the technology. Participant's interpretation and reinterpretation. • Historical and contextual information	• Provided in participants' own words, their interpretation and understanding of problems and issues related to the systems' development and use. • Corroborated data with other sources	• Assisted in discovering, activities, entities, processes, forces, and the contexts that shape the system's development, and use in the context where the system functions
Documentary evidence, blogs and press releases	Textual data in the form of: • Official records and e-financial ecosystem in South Africa (SA) • Business models of the case organization • Historical and chronological data • Administrative procedures	• Provided official and semi-official accounts of SA financial ecosystem, systems development, launch, acceptance, and appropriation. • Corroborated with other sources	• Assisted in discovering, activities, entities, processes, forces, and the contexts that shape the system's development, and use in the context where the system functions

5.5 Data Management and Preparation for Analysis

Data collection resulted in a large amount of qualitative data in a text format from both the primary and secondary sources. Nvivo (QSR10) was used to create databases to store and manage the various data collected, including the researcher's reflective memos. Nvivo has hypertext capabilities that allowed the researcher to link between various databases with the ability to index and code the data (Hutchison et al. 2010). Thus, integrating the various research activities in terms of the raw data collected, coding, codebook development, reflective memos, and recording methodological decisions in Nvivo captured the 'audit trail' for the research (Guba 1981; Hutchison et al. 2010). Separate databases were created in Nvivo to store participant observation data, researcher's memos, the transcribed interviews, and the documents, summaries/abstracts of documents, with capability to link them together.

5.6 Data Analysis for the Exploratory Case-Study

Data analysis was an ongoing concern with the initial analysis that began with data collection. Intensive data analysis started after the completion of data collection, managing and storing the data in their respective databases created in Nvivo. Such analysis required that the stored data be organized in some way in respect to the purpose of the exploratory case-study, which was to explore, discover, and describe or explicate events (i.e., emergent usage of adaptive IS for e-financial services) (Braun and Clarke 2013; Merriam 1988). Using the exploratory research purpose as the initial guide allowed the researcher to search the data for broad categories which are: *macro context, meso context, case events and analysis, and characteristics of the software artifact*. These broad categories were then scaled down into smaller, more exclusive categories and data were coded into them (Evanciew and Rojewski 1999, pp. 7- 8).

The participant observation, interviews, researcher's memos, field notes, and documents stored in Nvivo databases were exported to Microsoft Word. This was used for manual coding of the data that was purely inductive (i.e., atheoretically done), rather than using Nvivo. In fact, it was difficult to understand how the

different categories knitted together to make a descriptive sense from the data when the researcher tried to use Nvivo (Welsh 2002). Thus, under the *macro* context as a broad category, a smaller category named *e-financial service environment in South Africa* emerged, while under the *meso* context as a broad category, the following smaller categories emerged: *case organization and description, organizational structure, and daily work activities of employees*. Other broad categories such as case events and analysis held the followings: (1) *2012-2013: Initial steps and business model*, (2) *2012-2013: Launch users' acceptance, crisis, and transition*, and (3) *2014-Date: Rapid growth and business expansion* as smaller and more exclusive categories, while the characteristics of the software artifact held *features of the technology* as the smaller category.

Categories were determined when they reflected the purpose of this exploratory study, were mutually exclusive, independent, and exhaustive (Braun and Clarke 2013; Merriam 1988). The essential features of the smaller and more exclusive categories were then analyzed to determine their interactions, their interpreted meanings, and contexts of interactions. By doing this, the researcher could determine what it all meant as findings, in the form of a descriptive whole, that tell the story (Braun and Clarke 2013; Wolcott 1994). For convenience, the findings were placed in the next chapter, where the categories were organized into relevant and definable topics and subtopics, to give a better understanding of the context and the case description (Danermark et al. 2002; Wynn and Williams 2012). Some of the findings were interspersed with prior literature where necessary to strengthen the description (Braun and Clarke 2013).

5.7 Chapter Summary

The chapter began by introducing the overall case-study research design and the preliminary multiple data collection strategies used to explore, discover, and describe events, activities, forces, and contexts that shaped the system's emergent usage. Reasons for choosing a single case-study were specified, and its commensurability with critical realism demonstrated. Thereafter, the preliminary exploratory case-study research work carried out was procedurally addressed. This included three techniques of data collection – participant observation, interviews, and document

analysis. Thereafter, the intensive data analysis was discussed, detailing how the data were put into broad categories. The *“broad categories, then funneled down into smaller, more exclusive categories”*, wherein interactions needed to make sense of the data as findings were elaborated on (Evanciew and Rojewski 1999, p. 8). The next chapter will discuss the findings of the empirical work.

Chapter 6

Context, Case Description, and Analysis

"Before you impose your theories on the people you study, find out how these people define the world."

(Spradley 1979, p. 5)

6.1 Introduction

This chapter discusses the findings from the exploratory case-study as described in the preceding chapter. The discussion is shaped around the broad categories that emerged from the data analysis, which also capture the purpose of the exploratory case-study. The broad categories are: *macro context, meso context, case events and analysis, and characteristics of the software artifact*. These categories were also considered as definable topics, while the smaller and exclusive categories attached to these broad categories are seen as subtopics in the description. The description gives a better understanding of the context in which the technology is situated, the events leading to its emergent usage, and the unique characteristics of the IT artifact that constitutes the technology.

The case description and analysis allow for some "*explication of events*" associated with the system's emergent usage, using everyday concepts (Wynn and Williams 2012, p. 796). Even though the case description takes the form of a consultant report, it is interspersed with literature and it does not necessarily use the vocabulary extracted from the participants (Wynn and Williams 2012). Thus, the participants' feedback was solicited to validate the write-up (Bygstad and Munkvold 2011a). The case description does not account for everything that happened at the research site; rather, it is focused on the aspects relevant to the research agenda. From the case description can be inferred the causal mechanisms that operate as a "*foundation for*

understanding what really happened in the underlying phenomena” (Wynn and Williams 2012, p. 797). Apart from better understanding of the phenomenon (Easton 2010a; Yin 2009), another aim of this chapter is to conjecture theories that can be used in the theoretical (re)contextualization/(re)description of the phenomenon, based on the preliminary empirical evidence available (Grover and Lyytinen 2015; Ngwenyama and Nielsen 2014).

6.2 Macro Context

6.2.1 e-Financial Service Environment in South Africa

The e-financial service environment in South Africa is the specific macro research context where the technology operates. Context describes the non-technical features that the introduced system is associated with. They are relevant to the system’s operations since its causal operative mechanisms do not function in a vacuum (Carlsson 2005). Timmins and Miller (2007, p. 10) define contexts “*. . . as settings within which any . . . [IS innovation] is placed or factors outside the control of the [IS innovations] . . .*”, which may include socio-technical relationships that may change throughout the system use. When this setting is a place, (in this case South Africa), it is considered as relevant to user-system interaction, and also to the unintended consequences that emerge as a result of its use (Dourish 2004; Markus and Robey 2004).

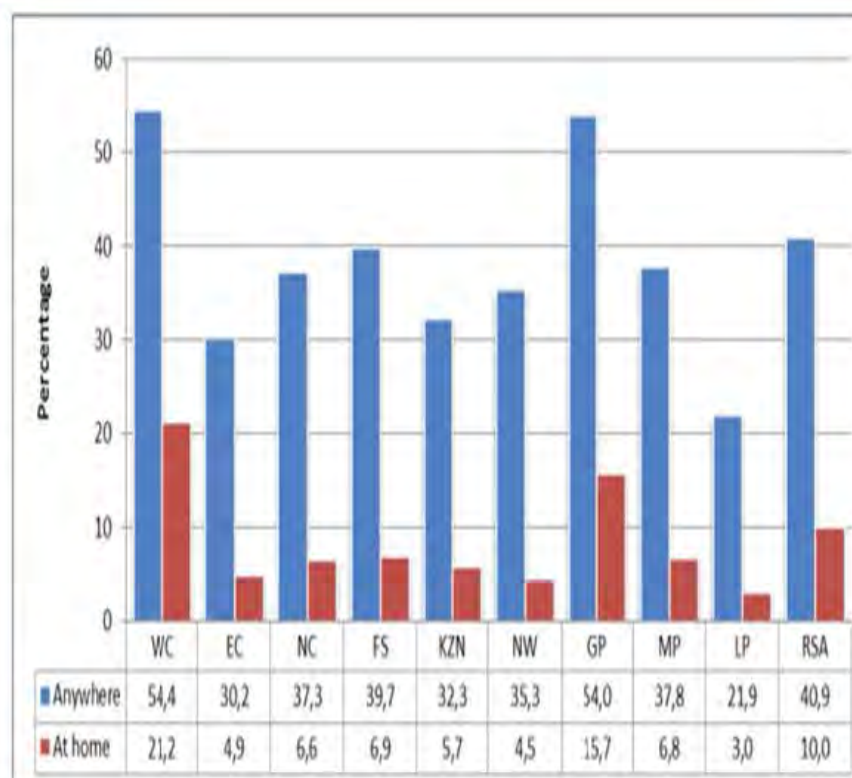
South Africa (as seen in Figure 18) is located at the southern tip of the continent of Africa, with a population of about 52 million (SSA 2014). With a rich tapestry of cultural, ethnic, and linguistic diversity, the main four groups of the population are: Black African 79.2%, White 8.9%, Colored 8.9%, and Indian/Asian 2.5% (SSA 2014). These groups of the population reflect the cultural and linguistic diversity, having eleven official languages, with English as the main language of governance and business.



Figure 18: Map of Republic of South Africa (CIA 2014)

South Africa has well-developed energy, financial, transport, legal, and telecommunications sectors with abundant supply of natural resources (Brown et al. 2007). The country is a relatively young, democratic, highly inegalitarian country, with socio-economic problems due to the after-effects of the defunct apartheid regime, that gave way for the introduction of democratic governance (Luiz and Mariotti 2011).

As illustrated in Figure 19, about 40% of the population have the capacity to ubiquitously access the Internet in South Africa as at 2013 (SSA 2014). Out of this segment, 30.8% access the Internet using mobile devices predominantly in order to access e-financial services (WorldWideWorx 2014).



Place Internet accessed	Geotype	Province (per cent)									
		WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
At home	Metro	24,3	10,2	NA	NA	9,5	NA	16,3	NA	NA	16,4
	Urban	14,8	7,7	8,0	7,4	7,0	7,6	11,0	11,1	9,8	9,2
	Rural	10,6	1,2	1,8	4,3	1,0	1,7	7,7	3,3	1,7	2,0
	Total	21,0	4,8	6,6	6,9	5,7	4,4	15,6	6,8	3,0	10,0
At work	Metro	27,6	16,4	NA	NA	16,9	NA	29,5	NA	NA	26,5
	Urban	18,5	18,4	12,5	11,6	16,8	14,1	13,8	13,5	18,6	15,1
	Rural	14,6	1,6	2,0	4,5	2,9	3,8	9,4	4,5	2,2	3,2
	Total	24,4	9,5	10,2	10,4	11,5	8,6	27,5	8,5	4,9	16,1
Using mobile devices	Metro	41,3	42,3	NA	NA	28,7	NA	37,9	NA	NA	37,2
	Urban	25,6	29,9	37,2	37,7	32,9	38,0	42,1	42,5	27,7	35,3
	Rural	11,5	14,7	15,9	17,7	17,4	24,8	29,1	23,5	14,3	17,9
	Total	35,4	24,4	32,5	34,3	25,3	30,9	38,3	31,9	16,5	30,8
At Internet Cafes or educational facilities	Metro	20,1	11,0	NA	NA	8,8	NA	16,1	NA	NA	15,4
	Urban	10,9	7,5	3,8	11,6	10,8	8,8	8,5	6,5	5,2	8,8
	Rural	3,5	1,6	0,6	2,3	3,2	5,6	3,4	3,5	0,9	2,6
	Total	16,7	5,1	3,1	10,0	7,1	7,1	15,1	4,8	1,6	9,6

WC= Western Cape, EC = Eastern Cape, NC = Northern Cape, FS = Free State, KZN = KwaZulu-Natal, NW = North west, GP = Gauteng, MP = Mpumalanga, LP = Limpopo, RSA = Republic of South Africa

Figure 19: Percentage of South African Households with Access to Internet as at 2013
Source: Statistics of South Africa (2014)

As such, it is obvious that the South African e-financial market constitutes a crucial sector of the national economy. The market roughly replicates the scope of traditional financial services offered by various financial institutions via the web or mobile networks. These services range from account services to payment services, as well as selling financial products. The financial products include financial investments, mortgage credits, and other e-products such as financial advisory services, portfolio management, or debt information provision and e-tax advisors.

A wide range of functional and usable variants of these e-financial services are amassed in the adaptive e-financial system, under study as an e-financial suite. Such a system is deployed in the South African financial market, considered as a leading emerging economy (Seymour and Naidoo 2013). The economy has undergone immense regulatory changes since the attainment of constitutional democracy in 1994 (Kumbirai and Webb 2010). Presently, the financial sector is comprised of seventeen banks inclusive of the South African Reserve Bank (SARB) as the central bank, two mutual banks, and a number of foreign bank branches (AEO 2012). The retail banking sector consists of the four biggest domestic banks, namely ABSA, First National Bank (FNB), Nedbank and Standard Bank. They hold an 84% share of South Africa's banking market (Lawack 2013; Metcalfe 2009; SARB 2012). There are other non-banking financial institutions in the sector, such as the state-owned development finance institutions (DFIs) and the Johannesburg stock exchange (JSE), the eighteenth largest in the world as of 2011 (AEO 2012).

The South African banking sector is information and communication technology (ICT)-driven, urban-based, and well developed when compared to many industrialized economies, although they have recently faced low credit demand and rising costs (Kabanda et al. 2010; Kumbirai and Webb 2010; SARB 2012). The major local banks have already capitalized above the new Basel III levels (SARB 2012), but have not as yet met the *“new global liquidity standards [in 2012], because of slow economic recovery and the ratio of non-performing loans”* (AEO 2012, p. 10). Despite favorable gross domestic product (GDP) growth of 3.1% as at 2011 and *“the high level of financial sector*

development, about 37% of South Africa's 33 million adults . . . [lacked] access to banking services in 2010" (AEO 2012, p. 10) . Based on the GDP growth, the economy has been placed on a new sustained phase of the business cycle, reflecting, among others, an increase in formal sector employment trend (although this has slowed in recent times due to a global slow-down), and a constrained electricity supply in South Africa. A quarterly Labor Force Survey conducted by Statistics South Africa indicates that the economy created 573 000 formal sector jobs between 2010-2011 (SSA 2012). Despite the success in formal job creations, South Africa has consistently ranked poorly in the Global Entrepreneurship Monitor Survey in terms of entrepreneurial activity (Luiz and Mariotti 2011). Such ranking is evident of the fact that South Africa has one of the highest unemployment rates recorded internationally – 25.3% in the third quarter of 2010 (SSA 2012) Thus, there is insufficient entrepreneurial economy or informal sector that should have absorbed the surplus labor and created employment, expanded markets, increased production, and revitalized communities (Luiz and Mariotti 2011, pp. 47-48).

In South Africa, mobile money/mobile banking services are provided by the four biggest banks through joint ventures with mobile telecom companies and retailers (Lawack 2013). For example, a Nedbank and Vodacom alliance launched an '*M-PESA*' solution, Standard bank launched '*SnapScan*', a smartphone version of an ATM card and '*Instant Money*', a joint venture between the bank and a local retailer, SPAR. The bank also has '*PayD*' solution, a joint venture between itself and a company called Oltio, and MTN, a pan-African mobile network. Similarly, FNB bank entered the mobile money fray by launching the '*e-Wallet*' solution, while ABSA is currently concluding its trial run of *Near-field communication* (NFC) technology on mobile phones, in partnership with MasterCard. The commonality of these mobile money solutions by different banks is that both the banked and the unbanked are serviced through its money payment/transfer service features that allow funds to be loaded into valid phones. Despite the growth of Internet services in South Africa and its adoption in banking (i.e., Internet banking) since 1996, mobile devices for making payments are well positioned (Kabanda et al. 2010; Lawack 2013). The level of penetration of mobile phones and

internet-enabled smartphones is higher than that of computers in South Africa (Lawack 2013; SSA 2014).

Industry studies (e.g., Ernst and Young 2011; Metcalfe 2009; PwC 2012) reveal an erosion of public trust in South African retail banking. The erosion of public trust is attributed to the after-effects of the global financial crises and the ugly consequences of the securitization of mortgage loans. There has been a noticeable collapse of liquidity in the market, increased capital requirements, and a reduced risk appetite among customers (PwC 2012; SARB 2012). Noticeable de-service, asymmetrical information, and higher product pricing has been revealed by industry studies as contributing to customers' attrition in most South African banks (Ernst and Young 2011). The fragility of the world economy with the possibility of a return to the recession has also led to customers' thrift spending, the desire for information to make informed decisions, and the cultivation of saving culture (Kumbirai and Webb 2010; PwC 2012).

The banks came under scrutiny in 2008 by the Competition Commission. Their report revealed that retail banks in South Africa are the only institutions in the world that charge fees on customers' deposits, as well as having the highest fee charges among world-class retail banks (Rootman 2011). Based on this report, the banks have deployed various internal strategies to reduce pricing mechanisms (Kumbirai and Webb 2010; Rootman 2011). However, the general belief among South African banking customers is that their banks run a water-tight closed structure with expensive pricing mechanisms.

To extend cheaper forms of banking, banks, in strategic collaboration with supermarkets, have established digital retail banking services, also driven by mobile networks (Maumbe 2006). The '*Mzansi Account*' is the most popular among such forms of cheaper banking services, availing poor South Africans access to digital banking services, even via the Post Office. These cheaper banking services also assist the banks to absorb people's savings and channel them towards the most efficient application in the economy (Maumbe 2006).

The legal institutions, in collaboration with SARB, deal with the broad financial legality and regulatory settings. Among them and of interest in this study are the Nation Credit Act (NCA), Electronic Communication Transaction Act (ECT Act) and the Protection of Personal Information (POPI) Act of 2013, all of which govern electronic activities and online privacy issues (Kabanda et al. 2010; Mujinga 2013). These legal acts have criminalized money laundering and terrorist financing; they regulate and guide against financial cybercrime, and govern security and privacy issues (Lawack 2013). SARB, through these legal frameworks, has also put in place modalities to ensure that anti-lending usury practices and customer due diligence requirements are complied with by the banks (Lawack 2013).

Politically, “*the government has created alternative channels of small- and medium-sized enterprises (SMEs) financing*”, giving credit guarantees to small businesses to enable them to obtain loans from the banks (AEO 2012, p. 10). The Broad-Based Economic Empowerment (BBEE) Act of 2003 was enacted to redress the socio-economic disparities of the defunct apartheid regime and to promote economic transformation. Its implementation has provided some economic opportunities, previously not available to black South Africans, to ensure an equitable society (Maumbe 2006).

The demands of South African customers have gone beyond the basic mobile and Internet banking services that are now widely provided (Kabanda et al. 2010; WorldWideWorx 2014). Digital banking has evolved into a richer set of offerings to provide new value for customers through a new ‘*digital feature set*’ such as the near NFC mobile app ASBA bank is pioneering, or the adaptive e-financial portal under study in this thesis. Apart from the high level of personalization, another important aspect of the e-financial portal is in offering intermediation in financial product sales for individual and corporate users. With well-arranged catalogs of products and services of banks and other financial institutions, the e-financial portal presents tools for comparing and selecting products and services that best suit individual user requirements. It is evident that the inability of the domestic banks to offer these digital capabilities has led to third party alliances with the banks.

Generally, the demand for the e-financial services the system under study offers and the digital app for banking services have posed many interesting challenges to the financial market and people in the following ways: Firstly, customers' varied and personalized tastes notwithstanding, customers are becoming more connected and better informed, with a general trend towards greater control and interaction with services they purchase (Gordon et al. 2010; Kumbirai and Webb 2010). Secondly, digital ecosystems are emerging due to social media providing new ways of interacting. Financial institutions are using such media to build communities around their product offerings and branding, despite the early adoption status of social media in organisations and the legal uncertainties, as brought about by the POPI Act (Accenture 2011; Chikandiwa et al. 2013). Thirdly, the advancement in broadband wireless Internet and the cheap availability of smartphones have not only led to the creation of an abrupt payment channel for customers, but also offer an opportunity for the provision of a new innovative channel, even for non-banking firms. With matured mobile cellular coverage in most African countries, the pendulum has swung from banks being the sole owners of banking services to third parties who develop boundless banking and payment services that are skewed towards personal relevance. Fourthly, there has been erosion of customer trust in banks in the wake of the financial crises, and trust in the effects of the best practices from online retail shops, as they become sophisticated in managing customer relationships. Lastly, the new generation of customers prefers emerging digital channels and open pricing strategies, since financial products have arguably always had an element of 'grudge purchase'. Digital channels have completely changed not only South Africa, but the global financial landscape (Chikandiwa et al. 2013; Smith and Fischer 2011).

6.3 Meso Context

6.3.1 Case Organization and Description

The case organization is 22seven, which, in proxy, provides the adaptive e-financial system or portal on behalf of the Old Mutual Group. Due to the provision of the e-financial service-system to Old Mutual customers and even to would-be customers,

22seven has become an important strategic arm of Old Mutual e-financial services. Old Mutual is an international long-term savings (LTS), protection, banking, and investment group. With locations in Africa, Europe, America, and Asia, Old Mutual was founded in 1845 in Cape Town, South Africa. It has over 14 million customers and approximately 55 000 employees. For the year ended 31 December, 2012, adjusted operating profits before tax of £1.6 billion were recorded, with funds under management amounting to £262 billion. In brief, the main business operations, brands, and locations of the Old Mutual Group are shown in Table 14.

Table 14: Locations , Brands, and Business Units of Old Mutual Group					
Business Units	Banking	Long-term savings	Short-term insurance	US Asset Management	e-financial portal and services
Location	South Africa	Southern Africa, Nigeria, Europe, Colombia, Mexico, India, and China	Southern Africa, Nigeria	US and UK	South Africa
Brands	Nedbank Group	Old Mutual, Mutual Federal, and Skandia	Old Mutual, iWyze	Old Mutual Asset Management	22seven.com

Prior to the acquisition by the Old Mutual Group, 22seven was an independent software developing company running an online personal finance and management (PFM) system in South Africa. Presently, they have expanded to include a widget-based Internet banking and electronic mobile e-financial service solutions. Despite their acquisition by the Old Mutual Group, 22seven still retained their unique identity and the strategic vision of its earlier founders.

Users of the technology are both customers and non-customers of the Old Mutual Group; they are also customers of banks, making this technology the largest and fastest growing service of its kind in South Africa. The web portal automatically pulls the bank, credit card, mortgages, loans, and investment transactions from over two hundred South Africa financial institutions daily — giving users an up-to-date view of their money. It is an open system and evolves during use, with design and usage activities, redistributed across time and levels of interaction, within the e-financial ecosystem. The system supports flexibility and, since it evolves in the hands of users to meet their

requirement changes, the design is never completed. It empowers end-users to reconfigure solutions to their problems while-in-use, because they pursue different task accomplishments on the basis of personal relevance (Senathirajah and Bakken 2011).

6.3.2 Organizational Structure

Despite the Old Mutual Group acquisition, 22seven retains its organizational structure. Such a structure could be described as horizontal hierarchical with a high level of flexibility to foster decentralization of decisions. The hierarchical undertone in such a fluid structure gives stability among the top echelons, while the work structure is highly flexible, flat, and environmentally responsive, to support the development of a system whose usage is not well understood in advance. Thus, the organization puts up cross-functional teams of diverse experts to perform all roles, wherein rotations from one role to another become the practice. Due to the unpredictability of the final usage of the technology, the management advocates collaboration and a self-organized kind of leadership strategy that relies on people's expertise and competency. By this, tacit knowledge sharing is facilitated and coordinated primarily through face-to-face communications. Figure 20 captures the simplified version of the organization's structure.

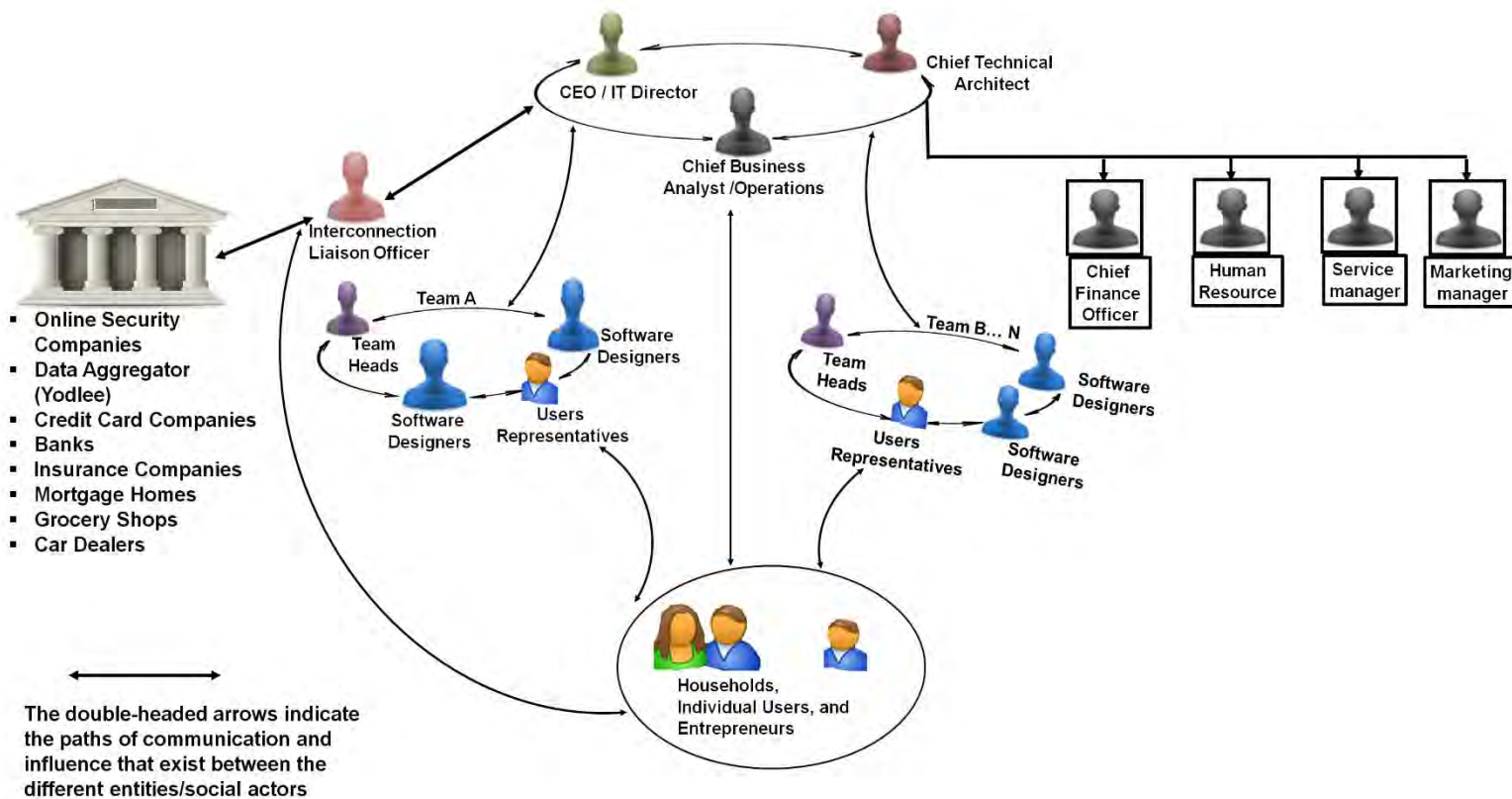


Figure 20: Organizational Structure of 22seven

Being powered by the Agile manifesto, the management approach is not based on plan-based styles that focus on standardized and well-defined processes. 22seven adopts an incremental development process, where roles are executed in parallel and there is not a well-defined separation of the phases. Every team member works with the basic understanding of the business goal or users' real life banking and financial activities that should be converted into IT architecture; thence the architecture is designed, tested, and deployed into a solution in collaboration with the users. This process is not linear due to the changing needs of the users; it has a strong emphasis on collaborative-based knowledge sharing. Such a sharing is facilitated by effective communication that requires a high level of mutual trust among self-organized teams, as well as frequent interactions. With dedicated managers and operational teams, disputes are settled at a higher business level. As a result, teams are shielded from any discourse or potential politics; this enables them to be focused on high levels of productivity and engagement.

The business drive is anchored by the initial founders prior to its acquisition – '*the three-wise men*' – as they are fondly called in the organization. Consequently, the founders – *the CEO/IT Director, Chief Business Analyst/Operations and the Chief Architect* – assume the ultimate decision-making authority, from where the teams share a sense of common mission. In the course of fieldwork, it was observed that the roles of the founders are rotatory for, after the release of the 'beta version', the Chief Architect assumed the role of the Chief Business Analyst/Operations. The founders set and share the holistic picture of the business goals, constraints, and risks. They also provide boundaries within which the members of the development teams can make decisions and the founders assume responsibility for those decisions.

Breaking their roles down to individuals, the *Chief Business Analyst* is regarded as the overall business owner, with business process expertise for which users' solutions in the form of widgets are developed. He has a deep understanding of the banking industry and the organization's focus; he assumes the role of true representative of the end-users at the top echelon. He initiates the agile development workflow process in 22seven and communicates the process information, with that of its security implications, to the rest of the teams. This allows for the discovery of inner meaning and inconsistency that is

essential, while dealing with differing opinions and conflicts among team members. He comments:

As a business analyst I must speak the language of the ordinary people, clearly glean from their understandings of what they need the system to do, why, how they will use it, what they use it for, and then make the entire package incorporate all of those differing needs in ways that all want to use, not just can easily use. (#M2)

The *Chief Architect* converts the business requirements from the Chief Business Analyst into an IT design that becomes the blueprint for the solution being created. He creates consensual understanding around the IT architecture, while researching on the latest techniques critical to keep the design simple and to review design patterns. The consensual understanding of the IT architecture is communicated to the development teams that reorganize themselves in various configurations to meet the challenges. This is summarized in his brief comment:

The chief architect answers the questions, what should we build and how can it solve users' real-life situations and their unanticipated desires. As we work along this line, we make it easy for users to achieve their goals. (#M3)

The *CEO/IT Director* is the chief coordinator in the organization. He liaises with other functional teams in the organization, for example, the investment and marketing units, to develop a holistic and dynamic management style deemed fit to confront the ever-changing business value. He also liaises with the necessary external partners via the interconnection liaison officer and supervises the proper functioning of security mechanisms around their networks. The *CEO/IT Director* assesses the eReadiness of the organization and the commitment displayed by the organization in sustaining the emergent usage of the technology in the public domain (Molla and Licker 2005).

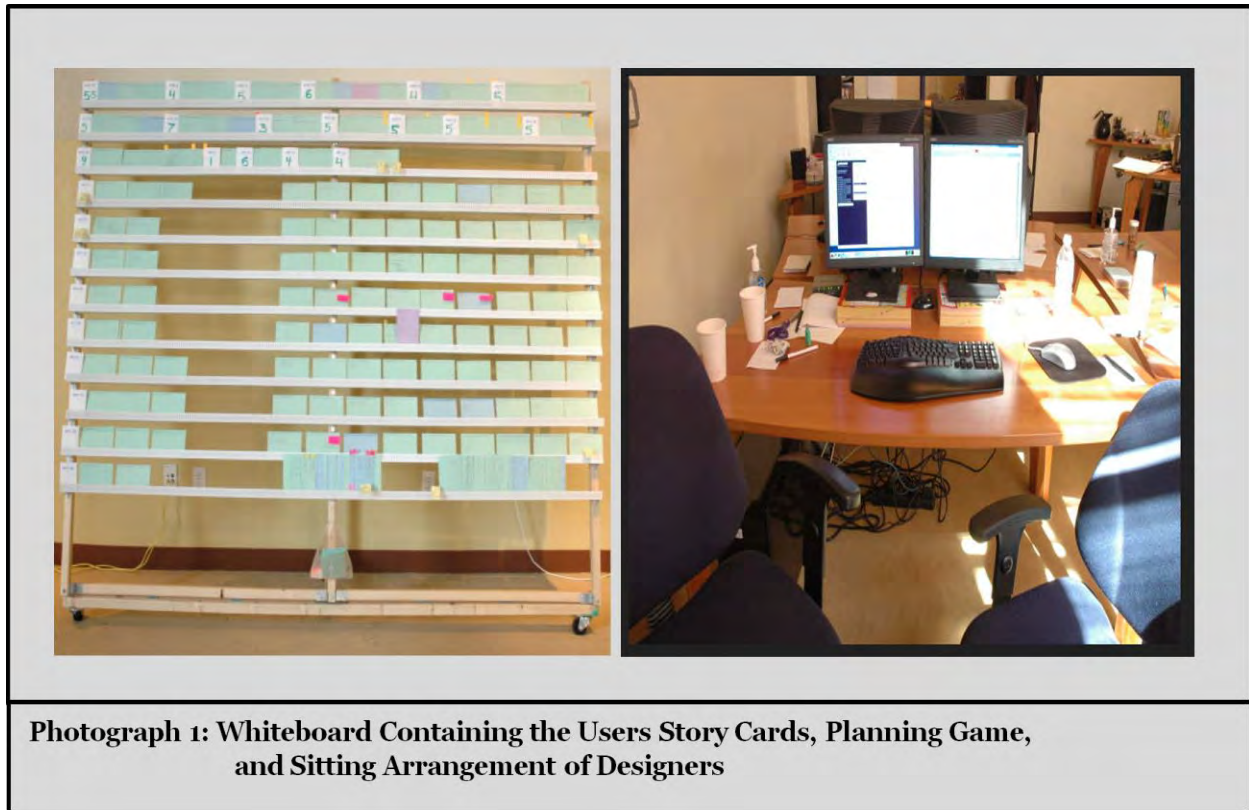
With a thorough understanding of the end-user complaints and their success stories, the CEO/IT Director manages the media communications of the organization. Among other duties, the CEO/IT Director usually carries out high profile marketing briefs and

meetings with the strategic partners of the organization. Having been in the South African banking ecosystem for long, he has a thorough understanding of the business. He was the tech-entrepreneur who owned *20twenty.co.za*, the first South African pure Internet bank, in 2002. However, the Internet bank closed down in 2004 due to strategic misalignment and the collapse of its anchored ‘bricks and mortar’ bank. In all, major decisions in the running of the organization are taken during intermittent and ad hoc management meetings among the co-founders. Most times, such meetings are based on the feedback from users and cross-functional teams, or other pressing issues that induce a strategic leap or focus. The *CEO/IT Director* comments:

Our style of leadership is taking proactive action to change something for the better, which every member is entitled and expected to imbibe. As our market space is always emerging, we deliver value through continuous learning from the successful and failed experiments, rather than executing a master plan toward a static goal. (#M1)

6.3.3 Daily Work Activities

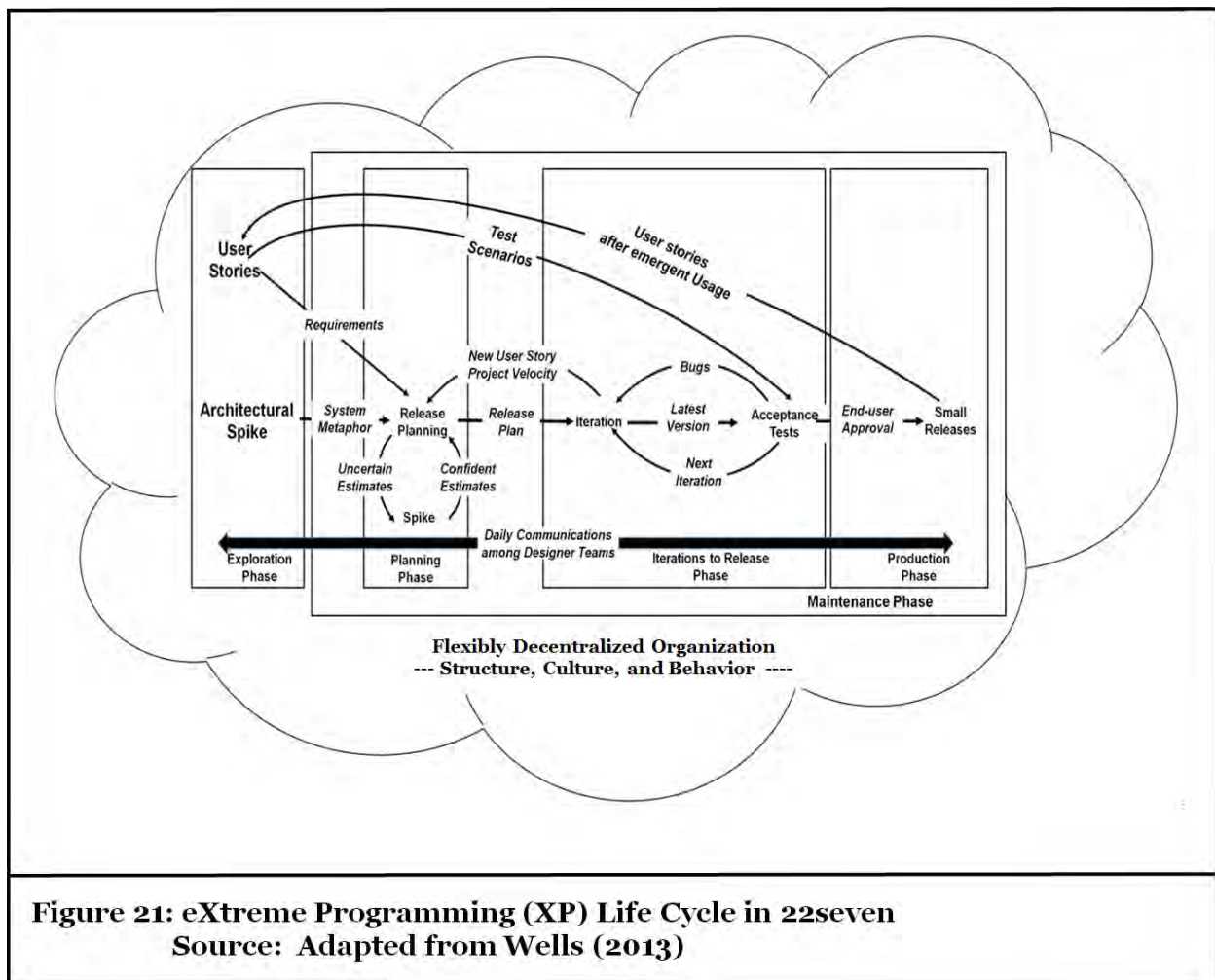
In the daily work activities of the designers, there are five teams. Each team consists of four software designers working in pairs with a workstation that has two 1280 x 1024 monitors, one keyboard, and one mouse. As shown on the right-hand-side of Photograph 1, the left screen is mainly for the code editor and the right screen is the portal console/manager.



Software designers here utilize their own creativity to produce socio-technical environments which end-users can build upon to be creative. The design activities in the case organization are not projects that must have a fixed end. Rather, by software coding, designers create malleable IT artifactual structures to support the evolutionary tendencies of the application, until its end of life (Giaccardi and Fischer 2008). The IT artifact so created becomes a symbolic representation of real life situations where its future use cannot be completely anticipated at design time (Fischer and Herrmann 2011; Wand and Weber 1995). The socio-technical system so created is embedded in ICT and banking legislative structures. Thus, the evolving system becomes a content-creation tool that empowers end-users to adapt to their e-financial needs that are legally situated.

The daily work activities of designers are in line with the agile development method of eXtreme programming (XP) (Vidgen and Wang 2009). Agile development is a suite of iterative and incremental software development methods. Apart from XP, other agile methods include Scrum, Crystal, Feature Driven Development (FDD), Lean

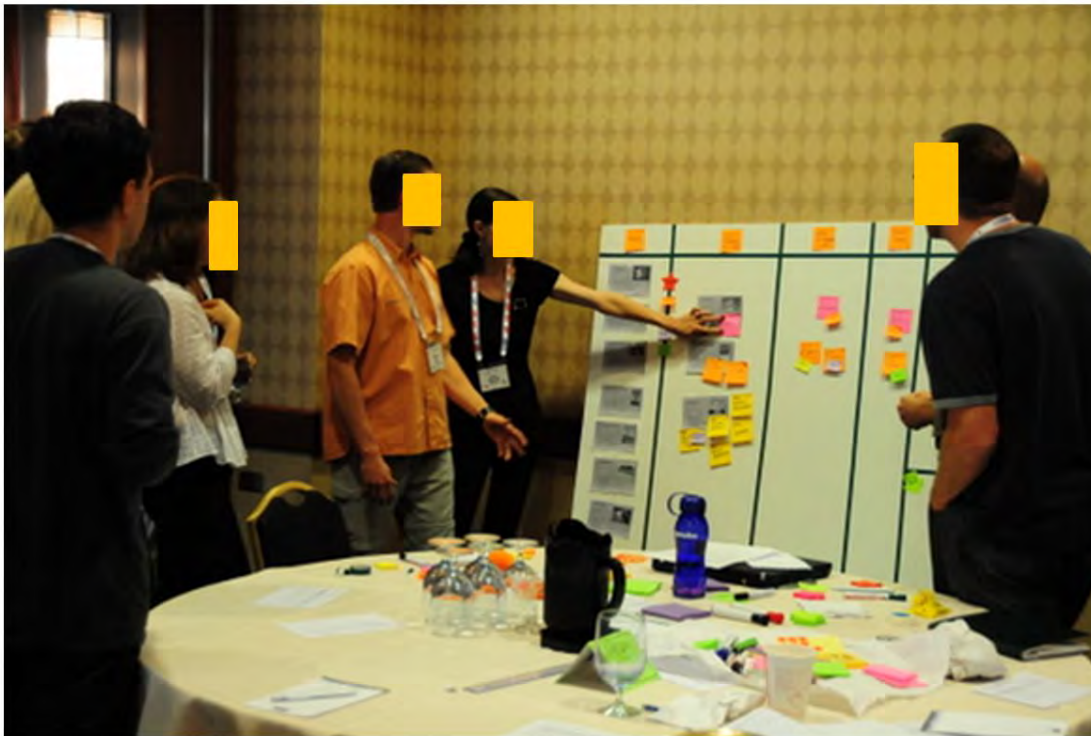
Development, and Dynamic Systems Development Method (DSDM). With the modified version of XP, the system's initiative is broken down into smaller projects. Each team then works in collaboration with the users' representatives to develop features that reflect the users' needs, which in XP parlance is called 'user stories'. The whole system design is not done together. Rather, each team works in parallel to others with a pass on their acceptance test, but occasionally they do meet to synchronize outputs, as Figure 21 attests.



Also, Figure 21 shows the major elements of the XP life cycle in the case organization, where user requirement changes and satisfaction are entrenched in the system development through the iteration process. The iteration is a constant code improvement (i.e., refactoring) event in which the production version is updated (Batra

et al. 2010; Wells 2013). Users usually validate such an event through an acceptance test (Batra et al. 2010; Wells 2013). User stories after the emergent UX of the technology become the catalyst for user requirement changes via the iteration process.

A stand-up meeting among the team members around the whiteboard usually heralds the start of the day job, as shown in Photograph 2.



Photograph 2: A Typical Standup Meeting of the Software Designers and the User-group Around the Whiteboard

Such a meeting is carried out in order to understand the status of the implemented story cards wherein colored stickers are placed on cards to denote progress. Decisions are made about which story cards each pair should work on and the people responsible. Everyone is briefed with up-to-date changes, challenges, and progress. A common practice is for software designers to switch pairs regularly, whenever a current task is completed. Pairs pick up the assigned cards and return them at the close of the day with

status reports. Time spent must not exceed 40 hours per week to discourage overtime working practice.

The difficult aspect is to get designers to accept fixed-scope agreements or agreed time to finish the work, because they realize that change will happen. However, when finished, the ad hoc '*release team designate*' integrates the work with other changes to the production website at least once a week or month, depending on its urgency. Such a regular update positions the system to address unanticipated usages and is an excellent basis for the team to monitor, collaborate, and share codes to enhance their workability. The shared code is stamped by the portal manager to identify pair/group authorship, as well as to allow other designers to modify it if there is a need, while being alert to users' support calls.

The grouping of stories constitutes a single iteration. Such a grouping becomes the workload to which each team commits to deliver in a fixed period of time. These user stories are embedded in the system metaphor which foretells how the system should work. The monthly/quarterly iterative delivery cycles involve all the stakeholders. They include the management, user representatives, PFM experts, financial investment analysts, online security/risk experts, and ad hoc release teams. They ensure ongoing alignment with the existing launch and the evolving user requirements. Thus, the actual workability of the web portal, as designed and reconfigured when in use, serves as the primary measure of progress. Asked why the organization preferred the XP method to other agile methods, one of the designers responded as follows:

XP places high value on simplicity and, unlike other agile methods, user requirement changes are embedded into the process as the main determinant of what gets done. On that basis do designer teams decide how things get done to ensure the daily running of the web portal. This is not to say, however, that Scrum, another agile method, is not adopted by us, it depends on the type of job, but we mainly focus on XP. (#SD1)

Individual members of teams are not designated with any role other than 'software designer' or 'a developer'. In this case, a 'software designer' simply refers to the shared responsibility of developing the system with rotating tasks whenever possible. Besides,

the teams are not grouped by roles such as architecture team or release testing team, but rather by the type of work at stake. There are database analysts, testers, or architects, but the naming is mostly symbolic; this is done to break the mindset that someone is an architect and therefore should not be responsible for testing the modules developed and so on. All the teams that launched the web portal presently assume the role of support teams. They are coordinated by the user representatives, who are also the user proxies. The *CEO/IT Director* maintains:

The best way to keep the workability and knowledge of the web portal alive is to maintain the continuity of the development team. Over time, we come to realize that continuing with XP to sustain the web portal reduces total cost of operation significantly. (#M1)

The user representative officers assume the role of the product managers in their respective teams, to coordinate the use and daily activities of the designers (Fischer 2007; Heyer and Brereton 2010). The product manager generates reports from the portal manager/console for each team to analyze. The reports consist of users' activities and trends, which assist in establishing the usage pattern deserving of further attention or design response. Thus, such reports are augmented with the actual end users' needs/wish to balance their potentially conflicting interests, to form daily user stories. Such user stories now form the basic unit of work and are roughly equivalent to the actual user requirement changes. They are transferred to A5 hand-written story cards and are loosely glued on a whiteboard with details of how to accomplish the tasks. Such details are agreed to during the weekly planning cycles' meetings that consist of:

- 1) designers' assessment of the story cards,
- 2) users' prioritization of the story cards via their proxies,
- 3) time frame to code the story changes,
- 4) testing and quality evaluation of the coded story cards,
- 5) release and integration of the small changes to ensure a running web portal every day and, lastly,
- 6) user feedback.

Thus, the planning cycles make the iterative daily build of software codes and monthly or quarterly post-releases possible. Apart from users' feedback, the planning cycles also allow the chief architect's feedback to be incorporated into the next releases for continuous planning, to avoid architectural spikes. Guarding against architectural spikes is an important key to reducing risk in the system's workability and helps to keep pace with its evolution and emergent properties.

The whiteboard also contains reserved areas for the developers' to-do-lists, which are unrelated to the current set of stories. This includes cleanups, refactoring, and design issues to which they have not yet found a solution, as well as the date of the next software shaping workshop (SSW). The SSW facilitates user-groups' support in an interactive manner. The helpdesk support team engages users' support calls uninterruptedly, using English, with two employees dedicated to first- and second-line support calls.

Apart from face-to-face meetings, which are the core communication medium, other communication media include the internal click-to-chat feature on the portal manager/console, as well as 'Skype' connections with external software developers. Thus, designers' daily activities are embedded in a social context: "*characterized by trust, close collaboration, and mutual learning*" (Kautz 2012, p. 12). Such social activities assist the designers to build complex functionality, while simplicity in the user interface prevails to create an engaging online experience. With the culture of openness and collegiality, designers are receptive to changes that focus on iteration (Kautz 2012), while considering the existing usage and future extensions of the technology.

The daily work rhythms are done calmly, confidently, and competently, with an ambient atmosphere that is pervasive. Although the majority of the researcher's report suggests positive effects, it was noticed that individual autonomy of the designers is sometimes in conflict with group level autonomy. Such conflicts, though minimal, are hardly discussed in their various retrospective meetings that are mostly occupied with the status of the work done.

6.4 Case Events and Analysis

Following in the footsteps of Kuivalainen et al. (2009), outstanding situations, crucial events that occurred, and social dramas associated with the emergent usage events in the case analysis, are now discussed.

Findings from Phase 1 of the research design revealed a number of important events. The events occurred between 2012 when the technology was launched and 2014 when the 22seven.com's website traffic increased tremendously. Thus, taking the cue from this period of time, the case analysis was divided into three episodes, each of which is more fully elaborated upon in turn.

6.4.1 2012-2013: Initial Steps and Business Model

Leveraging on web-based big data analytics with a unique user model/data-mart, widget-based e-financial services were offered to users. This undoubtedly positioned the technology's relevance in the South African financial service value chain. The company sustained its competitive advantage over time by continuous innovation through the addition of new applications and features for its users. Even though 22seven did not engage in advertising campaigns to enlist users, it reached more users, especially 'digital natives' (i.e., youths) by leveraging on social media. It also engaged word-of-mouth referrals that were linked to effective customer relationship management. To further introduce the brand and create awareness, a segment of the higher socio-economic South African demographic group was targeted and contacted face-to-face by the top management. Business executives who were technologically knowledgeable and intrigued by the new web application were also harvested. Consequently, the reach of 22seven.com expanded rapidly across customers and non-customers of the Old Mutual Group over the three years of 22seven.com's existence.

To generate revenue, 22seven targeted audience of two types: (1) users and (2) customers. Users who are not customers of the Old Mutual Group but customers of other banks pay minimal fees for sign-on after a one-month trial period. They are

enticed by the compelling value proposition of effective management of their personal finances, transparency, and the individualized mode of savings that align with their cash inflows. The business model allows complementary service providers such as those who mortgage houses, sell insurance and have credit card companies who want to offer their services to 22seven.com users, and these companies are considered as customers. By charging interconnection fees to customers, as well as for every transaction initiated, further revenues are generated. The interconnected banks also pay 22seven when a user opens a savings account from the budgeted money or initiates a home loan based on the advisory features of 22seven.com. The same is applicable to car dealers and medical insurance companies. Major revenues stem from a widget-based and location-aware advertising capability that is in demand by advertisers and media companies. Such advertisements align with the augmented reality innovation to enhance the user interface and position such services so as not to be intrusive. The business model is enticing because users want control of their financial behaviors with customized interactions, built around how, when, and where they conduct their everyday banking activities.

6.4.2 2012-2013: Launch, User Acceptance, Crisis, and Transition

The commercial launch took place in January 2012, six months after the release of the *'beta version'*. At first, mostly young consumers enlisted in the system, after accepting the terms and conditions and were willing to release their banks' PIN numbers. However, the launch sparked security concerns within the public and banking sectors because of the issue of private login details being sent to a third party. The service requires the users' Internet banking credentials: account number, PIN, and password, to be able to aggregate their various accounts from different banks and other financial institutions, including the Old Mutual Group. Almost all South African banks issued stern warnings in the media and through emails to their respective customers about the risks of divulging their banking credentials. Most banks went so far as to threaten their customers to avoid 22seven operations by highlighting the legal consequences. Others anchored on the null and void of the fraud-refund contractual agreement that customers

had with the banks, should they patronize 22seven. In ABSA's Facebook was the following:



Internet Banking Security Warning
by Absa on Thursday, January 26, 2012 at 6:50pm

It is absolutely imperative that Absa customers, and in fact customers of all banks, never divulge their sensitive personal information, such as PIN numbers, passwords and one-time passwords, to any parties – via websites, phishing emails, phone calls, SMSes or any other means.

Disclosing one's sensitive information renders the customer completely liable for any losses that may occur due to phishing or other online fraud, as per Absa's online banking terms and conditions disallowing customers from divulging their sensitive information to any third party.

Aside from these serious security concerns, customers should also note that forthcoming redevelopments to Absa's online banking platform, set for release later in 2012, will include a variety of personal financial management (PFM) tools. These tools will enable our customers to consolidate information from various institutions, budget more effectively, create a visual dashboard view of their personal finances, and much more.

This rich array of personal financial management services will be integrated within the secure environment of Absa's online banking interface, removing any of the security concerns present in third party PFM tools like 22seven.

This will be provided to our customers at no additional charge to the regular monthly subscription fee. 22seven charges R70 per month, on top of one's existing online banking monthly subscription or bundled product fees.

Sites like 22seven conflict with the clear fraud awareness messaging sent out by all major banks, as well as the South African Banking Risk Association and the South African Police Force.

In their quick response, 22seven described the banks reactions as deploying fear, uncertainty, and doubt, to cast misgiving in the minds of potential users. They commented:

[W]hile the banks' disapproval hardly came as a surprise, we think the financial entities need to question their mindsets. To equate an accredited, high-profile e-financial portal with fraud and phishing parties is disingenuous. 22seven consists of an established team of industry veterans and has blue chip investors behind it. To cap it up we use the same security vendor – Yodlee – these banks are using and so the negative rouse about insecurity from the banks is uncalled for. Come to think of it, we don't store your PIN IDs, Yodlee does and if someone could hack it in our site, then the same is true for your bank online since we use the same encryption and the banks can't deny this. (Press release 2 Feb 2012)

While the media war raged, a considerable number of users disregarded the banks' threats and started engaging with the services of 22seven. Such users are classified as *explorers*: they are the relatively easiest group to be attracted when a new digital service is introduced (Massey et al. 2007; Parasuraman and Colby 2001). Being a representative of the first wave of users, they described the services as novel, interesting, and valuable, while the *skeptics and paranoids* (Massey et al. 2007; Parasuraman and Colby 2001), did not share the optimism and innovative beliefs of the explorers. Rather, with a deep sense of discomfort and insecurity, they described the digital innovation as risky. One user's comment that captured the essence of the argument was as follows:

We have to ask ourselves what is the underlying issue here. Is it 22seven for daring to bring to South Africa a new service that is needed, much like mint.com does for USA? Or perhaps we should be asking our local banks, why they have not brought us tools to better manage our money? . . . Yes, we have trust issues . . . but should we not be asking why the banks aren't looking forward in providing better tools for us, their customers. Regardless which way we look, and no matter how safe or risky their service, the Bank's Terms and Conditions make it impossible for us to look elsewhere. (#M27)

Over time, FNB relaxed their earlier decision and became the first South African bank besides Nedbank to allow their customers access to 22seven.com. The banks educated their customers on how to create read-only access to their Internet accounts to 22seven, if they so wished. Lee-Anne van Zyl, CEO Online Banking at FNB, issued a press release stating that:

FNB has set a precedence of responding to our customer's needs with innovative products and services. We are now providing a secure means to engage with 22seven in response to our customers' need to learn more about their financial behavior . . . it remains the responsibility of the client to ensure that their secondary user is set up to 'view access only'. However, FNB will work closely with 22seven to ensure that our customers only use the 'view access only' profile when using the 22seven service. (Press release Tue, Feb 14, 2012)

This singular act of FNB in accepting 22seven redefined the trajectory of user acceptance of the system and it went further to gradually threaten other banks' stiff opposition to 22seven services. Traces of customers migrating to 22seven began to be noticed by banks. At some point, the early adopters became advocates of the 22seven.com website and questioned the rationale behind the banks denying them such services. A user of 22seven.com commented:

I think 22seven is awesome and the banks are just being resistant to change because they do not want us to see what we are not supposed to see or launch their own e-financial portal similar to 22seven. Whatever be the case none of their service will be anywhere near as awesome as 22seven. Would like to completely cut ABSA out of our lives, but our Home Loan was moved to them (not our choice) and so we are stuck. I already got rid of my savings account with them and moved to other banks that support 22seven. (#M12)

Fear of customer attrition of this kind pressurized others banks to allow their customers to have access to 22seven.com, while ABSA continued to block access to it and promised their customers equivalent services. However, in late 2013, ABSA succumbed to customer pressure to allow 22seven access to their individual accounts.

In late 2013, 22seven refactored the web portal to include the recent POPI Act of 2013. Other major events that occurred were 22seven's acquisition by Old Mutual, the redesigning of 22seven.com to reflect the Old Mutual Group brand, and the launch of the Android version of the mobile app. The Android mobile app is freely downloadable to users' Smartphones/Tablets via the Google store.

6.4.3 2014 – Date: Rapid Growth and Business Expansion

Being a ‘*digital financial disruptor*’ offering trusted and transparent services, 22seven has witnessed rapid growth in a short period of time. Its success has brought positive publicity among customers of banks in South Africa. Having been acquired by the Old Mutual Group, the technology is now integrated into part of Old Mutual’s online investments and banking services. Users get attracted to the strong brand of the new owners; this has led to an increase in its use. Significant expansion of the service has occurred in the form of financial planning and investment services, and advanced web analytics that can help users make sense of their financial behavior across different banks in South Africa. In addition, marketing to potential users has been re-strategized to support the repurposing of the technology to further match their needs. By this, users build up loyalty that is linked to the revenue logic and sales elements within the business-model. User groups – which have been rebranded as user engagement teams – have been streamlined to retain the domain expertise among them, with financial rewards. As with other emerging payment systems, the organization is re-strategizing its business model to better exploit innovative payment models. As they are not a ‘true’ bank, their present business expansion is towards engaging their parent retail bank to hold customers’ accounts, to enable them to offer full payment services. At present 22seven no longer charges access fees from users of their website.

6.5 Characteristics of the Software Artifact

6.5.1 Features of the Technology

The adaptive IS for e-financial services under study captures the notion of secondary design, where users become the primary actors of its continuous redesign and the evolutionary growth of the system in their context-of-use (Fischer and Herrmann 2011; Germonprez et al. 2011). Being a user-driven innovation (von Hippel 2009), the extent of its use is controlled by the system’s governance. The domains of responsibilities can be defined, letting each user modify only those parts for which they are responsible (Neumann et al. 2014). Therefore, the system is “*designed to adapt to dynamic*

reassessment of situations, to accommodate altered plans, and to mediate non-typical, independent . . . work” (Germonprez et al. 2011, p. 665). Being primarily designed for end-user adaptation, the system avails people of the opportunities to create situational tasks that address their immediate needs. Users can engage in acts of bricolage, appropriation, customization, or tailoring, where their reflections, actions, tinkering, and adaptation are supported and accounted for (Germonprez et al. 2011).

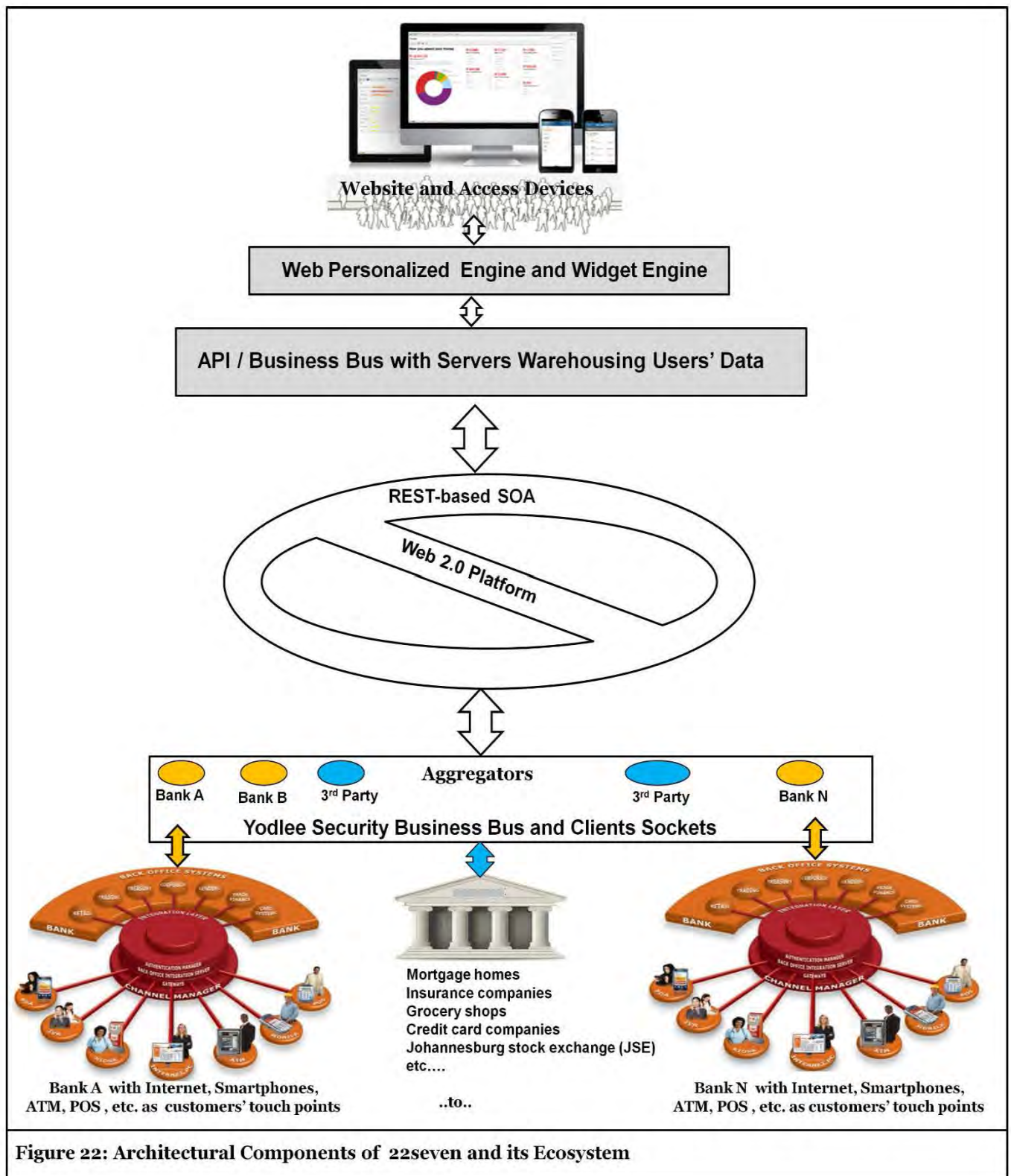
Emergent use can force the service-system to adapt, bringing in newer ways of interaction for e-financial service value creation. By this, the system enhances its sustainability by the additional creation of IT resources upon its installed base for creating services (Fischer and Herrmann 2011; Hanseth and Lyytinen 2010). Services in this case are distinct from web-services that capture the loose technological structures that facilitate the variable functionalities of the system (Alter 2010b). Rather, services are defined here as competencies, contents, and resources that the system provides for users, with the aim of creating value (Alter 2010b; Lycett 2013). Value in this case is not derived by exchanging the system’s output with a price (Alter 2010b; Vargo et al. 2008). Rather, value is derived and determined during use through annotation, adaptation, personalization, integration, and application of the system’s resources in a specific context, to achieve personal relevance (Mathiassen and Sorensen 2008; Vargo et al. 2008).

Software designers in this context become situated financial service creators of embodied IT structures half-way, waiting for the users to supply their own part in their context-of-use. For instance, designers create a ‘tagging mechanism’ in the adaptive IS, with default data entry as templates. Users thereafter adopt and adapt such templates to categorize their individual financial spending in respect of situations that warrant such spending. Thus, the designers, the users, and the IT structures interact and adapt for value co-creation within an ecosystem that mimics self-adjusting complex adaptive systems (Patrício et al. 2011; Vargo and Lusch 2011). The created value is evaluated as ‘value-in-use’ during the consumption process or during the appraisal of the usage experiences gained thereafter (Alter 2010a; Vargo and Lusch 2004). The evaluation in the service-system creates responses to the context in the form of positive user

experience that largely determines future re-use (Chandler and Vargo 2011; Lusch et al. 2010). For designers, there is an additional acquisition of expertise to fine-tune the system within each service encounter (Maglio et al. 2009).

The system's adaptation thrives in three key areas of interactions, due to its flexibility: functionality, presentation, and linguistics (Germonprez et al. 2009; Xiao and Benbasat 2011). At a functional level the system is modified in the context-of-use that changes the features of the system functionalities specific to the user. This could be an ad hoc recombination of services to fit specific tasks, or direct adjustments of the content of service information provided at the user interface (Germonprez et al. 2009; Xiao and Benbasat 2011). At the presentation level, systems are adjusted in the context-of-use that changes its appearances, such as interface colors, patterns, and layouts to connect different information sources or services (e.g., Rich Site Summary (RSS) feeds). The interface appearances also reflect how e-product information is organized and presented to the user, to encourage effective decision-making (Xiao and Benbasat 2011). Finally, at the linguistic level, modification captures socially negotiated information because of human interactions, to shape objects such as negotiated pricing in online mortgage auctions, or generation of service information based on users' interests (Germonprez et al. 2009; Xiao and Benbasat 2011).

Architecturally, the system is based on a Web 2.0 platform. It incorporates service-oriented architecture (SOA), as illustrated in Figure 22. Such a platform allows the system to be both adaptable and adaptive (Neumann et al. 2014; Pahlke et al. 2010) to accommodate planned and emergent duality of use (Germonprez et al. 2011). As the user effectively customizes the system, the system surreptitiously provides assistance by taking into account user characteristics, the task being performed on the interface, given the context-of-use (Pahlke et al. 2010).



The Web 2.0 platform is based on representational state transfer (REST) architecture for web services. REST architecture, in contrast to other versions of SOA, allows users' requests and responses to be built on transfer of representation of resources or tasks and it strongly supports multiple devices (Pahlke et al. 2010; Valdes et al. 2010). Thus, the architectural design is flexible to engage with mobile access devices to achieve end-user's modifiability. The SOA designs also capture a malleable and component-based architecture such as the enterprise service bus (ESB). Because of the REST-based architecture, users' task/business functionalities are encapsulated and delivered as web-services (Neumann et al. 2014; Pahlke et al. 2010). Such an encapsulation is done through the concept of loose coupling of web-services, orchestration of new solutions from existing functionality, and standardized access. It also has an application programmable interfaces (APIs) layer that connects applications with the business process. The architecture is often called 'RESTful' APIs, enterprise mashup, or web-oriented architecture (WOA) (Pahlke et al. 2010; Valdes et al. 2010). WOA manages and optimizes all aspects of the modules such as widget management, security/regulatory logic, content management, personalization, and the transactional analytics, altogether functioning as one common enterprise to achieve user experience interfaces (Pahlke et al. 2010; Valdes et al. 2010). To the designers, the REST-based interface provides for a collaborative co-creation of new and innovative use cases. Updates can seamlessly occur at any time without users' recognition to match end-user requirement changes, while providing control that guarantees task-process alignment (Valdes et al. 2010).

As Figure 22 illustrates, customers can perform their transactions in any of the banks or financial institutions, point-of-sale (POS) terminals, ATMs, Internet, mobiles, or credit/debit card accounts. Thus, all financial activities converge into individual customers' accounts as bank statements. Such statements are aggregated by Yodlee enterprise business bus, which also re-routes the data to individual user models/data marts. Users can then access their transactional data as a resource via the 22seven.com browser interface. Yodlee enterprise business bus is owned by Yodlee, a US-based big data aggregation company. It specializes in different bank account aggregations and other online financial services and, as such, 22seven has no direct linkage with South African banks, but through Yodlee as the strategic partner. 22seven also partners with

other companies such as credit card companies, insurance companies, Johannesburg stock exchange (JSE), mortgage houses, car dealers, and major grocery shops, to harvest all users' data transactions.

REST offers rich possibilities and flexibility for designers, but these are not directly leveraged by users. Therefore, RESTful APIs provide the plug-in of web-personalized engine for designers and the widget/mashup engine for users (Pahlke et al. 2010; Senathirajah and Bakken 2011). The widget engine emerges as a novel lightweight design principle that allows individual data to be mashed-up from different resources into a single integrated tool. By mashups, composite applications that address situational needs are built by using widgets.

A widget is a miniature application that triggers complex business interactions at the server-side in a background mode, while being embedded in the user interface as an icon (Gallego et al. 2013). Widgets are active creation tools, surreptitiously linked with other elements of the website, which include the functional features, as shown in Figure 23. Such features broadly define the financial products, economic news, information about financial markets (e.g., real estate, automotive, and stock trade), and investment guides, particularly within the Old Mutual jurisdiction. Other elements include online mortgage loan search and approval features, a variety of financial calculators (e.g., currency exchange rates, credit, interest, etc.), analyses of stock quote, trends, and net-worth calculators for producing personal balance sheets. There are also a wide range of user-communication features such as click-to-chat discussion groups and forums, personalized newsletters, user comments and reviews, blog space, and RSS feed. Presently, the technology does not engage in social network payments. Rather, it conducts a comparative matrix analysis of financial products to sharpen the users' decision-making process, among other uses.

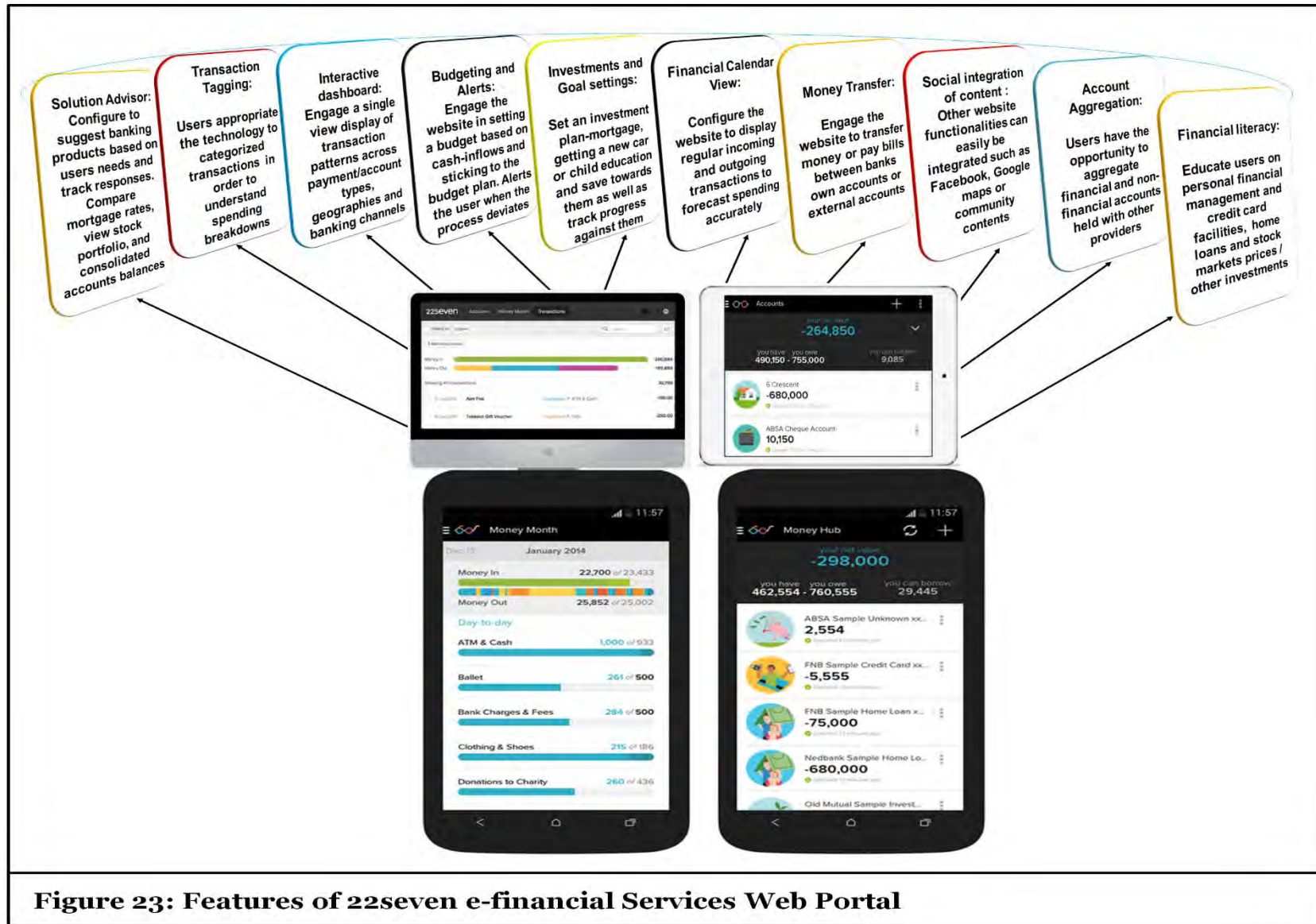


Figure 23: Features of 22seven e-financial Services Web Portal

To make effective use of the features seen in Figure 23, users engage with their smart mobile devices. As they swipe with their fingers, the screen dynamically changes forms, colors, and semantics, depending on the personalized haptic user engagement. Users decorate these smartphone payment devices with personal pictures of their loved ones or pets by the use of such payment widgets. The RESTful APIs design not only focuses on operational excellence, but it also optimizes user-orientated bundling of different services. Such interfaces bring an enhanced user-orientated engagement for banking services, where they can reconfigure and represent their individual financial data in a creative, visual format that assists them in understanding their financial behavior.

6.6 Justification for Using Theories of CAS and Meta-design

This chapter has given an overall account of the specific research context. This includes the South African e-financial ecosystem that harbors the operations of the technology, the description and analysis of the case organization that implemented the technology, and the features of the technology. As revealed by the case description, the settings were characterized by uncertainty and emergence with interactions that were nonlinear in its search to turn the technology's adoption into success. Designers' daily working environment is user-driven and self-organized, driven by decentralized structure that fosters trust, communication, and collaboration to position the organization. Thus, the technology so developed must account for its socio-technical mechanisms that span across the design and use time for achieving its emergent usage. Besides, offering e-financial services of this kind for consumers, the technology demands diverse information system infrastructures that are interconnected. Based on these settings, six reasons can be identified, which justify the use of theories of CAS and meta-design in this research.

First and foremost, what seems to characterize the context are fitted into an adaptive IS with emergent properties interrelated with three elements. This includes: (1) agents (social actors and IT agents) who constitute the entities for actions in both the design and IS use process, (2) adaptive interactions that are unpredictable with evolutionary

growth of the system to confront such interactions, and (3) an environment that represents the social and technical contexts of IS use with their interconnectivity (Fischer and Herrmann 2011; Nan 2011). Obviously, the understanding of theories of CAS and meta-design could attest to the fact that such a context could be explained by these theories. Apparently, the context/phenomenon would make a case for CAS theory and, more especially, CAS notions of adaptation and emergence fit the nature of the technology's usage and its development, both of which are driven by self-organized actors (Egyedi and Van den Berg 2012; Hanseth and Lyytinen 2010). Besides, the empirical evidence is embodied with socio-technical mechanisms that interact to produce emergent order (Egyedi and Mehos 2012; Nan 2011), where such order is contingent on the context where the technology is situated (Egyedi et al. 2007; Radulescu 2011); this could be explained by CAS theory as well.

Secondly, CAS theory tends to downplay the empirical evidence associated with the role of social actors in the evolution of the structures of the system, by reason of design and appropriation or design-in-use (Child and Rodrigues 2011; Dourish 2003; Fischer and Herrmann 2011). However, meta-design theory takes it up from there to provide an explanatory framework for design and design-in-use of the system (Carroll 2004; Fischer and Herrmann 2011). Therefore, the choice and integration of both theories of CAS and meta-design, especially in the minimalistic variant employed in this thesis, are sufficient to identify and explain the mechanisms responsible for the emergent use of the adaptive e-financial service-system under study.

Thirdly, empirical evidence suggests that to explain emergent usage of the technology demands a two-phase process. The first phase is the design environment (Henderson and Kyng 1991), where diverse social actors are seen to participate; the second phase is the *design-in-use* of the application, where actual users appropriate the technology (Ardito et al. 2012; Dourish 2003; Fischer and Herrmann 2011). However, the distinction between the two phases are blurred for the “*design environments evolve, both as a consequence of the progressive insights the different . . . [social actors] gain into the design process, and as a consequence of the feedback provided. . .*” by the appropriated system (Ardito et al. 2012, p. 81; Carroll 2004). Thus, meta-design theory

provides an excellent lens to investigate the concurrent and dynamic design and the use processes of the system, since design can only be complete when the user appropriates the technology (Carroll 2004; Fischer and Herrmann 2011; Hovorka and Germonprez 2008). As pointed out by Zhang et al. (2009), “[t]heoretical understandings [of IT use and impact] that do not feed design can eventually lose their relevance” (p. 95).

Fourthly, from the initial empirical evidence, it could be seen that to theorize emergent usage of the technology demands an understanding of the designers’ activities, the interaction of the users as secondary designers, the software artifact, the service contents, and the context, as they altogether evolve (Fischer and Herrmann 2011; Hovorka and Germonprez 2008). Each component and their relations necessitate theories of CAS and meta-design to incorporate each of the components, before adequate investigation to identify mechanisms could be meaningful (Hovorka and Germonprez 2008).

Fifthly, both theories of CAS and meta-design have a high degree of commonality in that their tenets have originated from system thinking, as well as with the phenomenon of interest (Fischer and Herrmann 2011; Mingers 2014). They share the same sense and semantic commensurability in ascribing causal powers to structures and mechanisms. The theories support sociomateriality ontology, but treat “*materiality as existing in the realm of structure and social action as existing in the realm of action and both can relate with one another*” (Leonardi 2013a, p. 66). Because of such relations, researchers can understand that artifactual structure and agency are both emergent strata of social reality with *sui generis* properties and powers in a specific and open context where the technology is situated (Archer 1995; Mutch 2010a). Technology in this view is not static, but exercises a great deal of flexibility; it emerged in practice by reason of the interactions between people, materiality of IT, and institutional environment at certain points in time, for a given purpose (Fischer and Herrmann 2011; Leonardi 2011; Nan 2011; Roxas and Coetzer 2012). Through the ongoing processes of recursive adaptation, users and designers constantly influence and adjust to each other’s emerging behaviors, ideas, and intentions – as well as with the technology-in-use – through a dynamic constellation of interactions (Fenwick 2010).

Sixthly, the theories of CAS and meta-design are consistent with critical realist assumptions that underpin this research because of a system thinking background (Mingers 2014). The upholding of the fact that structures are pre-constituted, relatively autonomous, and causally efficacious by both theories, empower them to be used for investigating the structure-agency relation over time (Byrne 1998; Fischer and Herrmann 2011; Leonardi 2013a). Both theories empower the researcher to embrace the diversity, historicity and contingency of UX; collect data about them for unveiling webs of causation, rather than relying on simple linear relationships that epitomize the traditional reductionist framework (Stacey 1995; Tredinnick 2009). Data collection and analysis along these lines are plausible, because actors and users of technology do not perceive the artifactual structures and the social as interpenetrated entities that could only be perceived by instantiations (Leonardi 2013a).

It is worth stressing that without the theories of CAS and meta-design combined, it might have remained largely elusive to theorize the causation associated with empirical evidence that emerged from the fieldwork. Nevertheless, the researcher argues that what characterized the phenomenon from the initial empirical evidence is indicative of some underlying causal mechanisms, which have to be identified if the study aims to explain the emergent usage of the adaptive e-financial system. Placed against the overview of e-financial services discussed, the case organization becomes, then, not just an organization that deploys an adaptive IS for societal use, but an exploration of the designers' and users' appropriation of the technology in their context-of-use. This resulted in the transformation of the e-financial services (Dourish 2003, 2004; Fox and Do 2013). Such a transformation is achieved when the IS innovation has disrupted the existing Internet banking services of banks to create new markets, through the introduction of new service offerings (Fox and Do 2013).

6.7 Chapter Summary

This chapter detailed the context, case description, and analysis as the first stage of a realist case-study intensive design discussed in Chapter 5 and as specified by stage 1 of Danermark et al.'s (2002) model. The case description and analysis explicated the events that are associated with both the development and emergent usage of the adaptive e-financial services under study (Wynn and Williams 2012). By fulfilling stage 1 of Danermark et al.'s (2002) model, the case analysis increased the researcher's sensitivity to context and specific variations in meanings, in order to derive or conjure up theories of CAS and meta-design from the initial empirical evidence (Eastwood et al. 2014; Ngwenyama and Nielsen 2014). Both theories are used to redescribe the research context in the next chapter, having laid the conceptual foundation and the preliminary empirical evidence needed for theoretical redescription as shown in the thesis structure in Figure 1.

Chapter 7

Theoretical Redescription

“... there is no defensible theory-neutral observation ... access is always mediated.”

(Fleetwood 2005, p. 199)

7.1 Introduction

This chapter discusses the theoretical redescription of the phenomenon as a critical realist way of particularizing theories into the empirical situation under investigation. It is aimed at developing a critical realist research model. To do this, the conceptual framework developed in Chapter 3 is engaged with, and integrated with, the extant theories (i.e., CAS and meta-design), in the light of the initial empirical evidence (Danermark et al. 2002). Theoretical redescription is an abductive pattern-matching process between the theoretical pattern and empirical pattern, which focuses on the nature of things lying behind its appearances as a re-contextualization of its constituent parts in a particular context (Danermark et al. 2002; Trochim 1989; Vega and Brown 2011).

Theoretical redescription amplifies abductive-retroductive reasoning that leads to the development of an embryonic theoretical model as a kind of working hypothesis (Mueller and Urbach 2013; Pawson and Tilley 1977). Such a model is constructed by matching the theories that seem to explain the phenomenon with that of the initial empirical data, and then refined gradually (Grover and Lyytinen 2015; Mueller and Urbach 2013). To further refine the model, it is compared with images which are constructed through the process of abstraction from future empirical observations

(Miller and Tsang 2010; Mueller and Urbach 2013; Ragin 1994). This ultimately leads to a new theory that is equally aligned with the empirical data, as well as generalizable analytically (Grover and Lyytinen 2015; Tsang 2013).

The redescription is done within the pragmatic context of the technology under study, including its design activities, emergent usage, service contents, and contextual conditions (Hovorka and Germonprez 2008). While doing this, deep conceptual and analytical thinking is employed in order to answer ‘how’ and ‘why’ questions about the phenomenon. The theoretical redescription also provides an explanation by specifying causal relations, moving from the concrete to the abstract, in the light of the congruence established between the conceptual framework and the extant theories that seem to explain the phenomenon (Danermark et al. 2002; Vega and Brown 2011).

Due to the varied structural mechanisms and contextual conditions embedded in the phenomenon, it is not possible to redescribe every aspect of the emergent usage event in the technology (Aaltonen and Tempini 2014). By means of the initial empirical experiences it is necessary to *“separate what is essential from what is dispensable in order to capture in our model a simplified picture of reality, which nevertheless will allow us to make inferences that are important to our goals”* (Simon 1990, p .7). The conceptual framework is used as a lens to scan through the initial empirical evidence and abstract the generative mechanisms that seem to be in operation. Abstraction here means *“among other things, to isolate in thought certain aspects of reality”* that operate in the phenomenon under study (Danermark et al. 2002, p. 169).

7.2 Abstraction of the Consequences or Outcomes

A critical component of theoretical redescription is the abstraction of the object of investigation as the explanandum/consequences, in order to confirm its existence (Collier 1998; Danermark et al. 2002; Sayer 1992). Following Aaltonen and Tempini (2014) which is also in line with abduction process (Danermark et al. 2002), congruence is established between the conceptual framework and extant theories of CAS and meta-design during the initial field work, to confirm the fact that there is evidence of

emergent IS usage events. The focus is on emergent IS usage events because the viability of the organization is strongly dependent on attracting users who will appropriate the technology to solve their financial needs. *“Focusing on such events and ignoring others is consistent with retroductive reasoning of not accounting for all the structures and mechanisms present at the research site”* with their respective generative outcomes (Aaltonen and Tempini 2014, p. 5). More importantly, insight from meta-design theory denotes that such a technology as is under study cannot exist without emergent usage to ensure its evolutionary growth in the context-of-use (Fischer and Herrmann 2011).

An excerpt from one of the software designers during the first phase of the field works clearly expressed the emergent usage of the technology as the prime concern of the organization. He stated:

Our prime purpose is to design for users' adaption for we cannot generally foresee their context of use. And based on our RESTful API technology, users can understand their financial behavior by playing with the widgets. It's fun seeing users track their investments, loans, and unit trust accounts from different sources and create their dashboards without our consent. With our product, users create their unique features in their smartphones and tablets or even PCs that are well aligned with current trends in the digital economy. (#M3)

Also, one among several end-users interviewed corroborated the view of the software designer:

My desire to understand my spending behavior was actually what made me sign on. I really like playing with the widgets in my mobile app to achieve my purpose. Many times I tweak the features to create solutions. For now I am linking the smart calendar feature of the technology to my home loan to remind me when to pay my interest, of which regular defaults in time past has spelled heavy consequences. (#U5)

Both excerpts clearly show that sustaining the usefulness of the system differs from the traditional concept of IS use; it transcends to widget-based appropriation of the technology to achieve individualized tasks. The need for such usage is experienced by the end-users who are owners of the problems, rather than by the system designers. One important claim behind this research is that such users are empowered to create the

unforeseen task accomplishments that amount to emergent usage of the technology. Thus, the user-system interactions here demands innovativeness of the users to transform the default design into something personal by modifying and repurposing it (Carroll 2004; Salovaara et al. 2011).

7.3 In Search of Generative Mechanisms and Factors as Antecedents

Having confirmed the existence of emergent usage of IS as the outcome, the next step is to search for generative mechanisms that might have caused such outcomes and the experiential factors that describe it. While the generative mechanisms work in interconnected ways and ‘rub’ against each other to constrain or enable people who interact with them, Archer’s (1995) analytical dualism can be used to separate them. Therefore, to abstract such mechanisms specific to the present context demands: (1) holding on to the conceptual framework while drawing on theories of CAS and meta-design in the light of the preliminary empirical evidence, and (2) thereafter employing retroductive logic during data analysis to validate the mechanisms. Underpinning this approach is the third stage of Danermark et al.’s (2002) model, corroborated by Yeung’s (1997) recommendation that mechanisms be abstracted from “*careful theorization and reflection*” of what could be the case in the phenomenon under study (p. 59).

7.4 The Enabling Structures

By drawing from the conceptual framework in the light of the initial empirical evidence, enabling structures in the study context are represented in the form of: (1) embeddedness and under-design (Fischer and Herrmann 2011; Volkoff et al. 2007), (2) the organizational structure (Alaa 2009; Patel et al. 2010; Uhl-Bien et al. 2007) and (3) information asymmetrical structures (Barbaroux 2014) that capture the impact of financial/banking structures on the phenomenon. In this section, theorization and postulation of these structures will be addressed. It starts with embeddedness and under-design as enabling agents of emergent usage of the adaptive e-financial system.

7.4.1 Embeddedness and Under-design

Embeddedness of routines into the structures of IS and its under-design process is a fundamental enabler of emergent system usage. CAS theory specifies that simple rules or routines that act as the '*guiding melody*' are deeply embedded into agents to condition their ordered interactions (Davis et al. 2007; Gell-Mann 1994; Holland 1995). In the IS context under study, the routines are the financial task routines, the individual interaction routines, and the organization's business routines that confine the variation of the system's use, while the agent is the artifactual IT agent and/or the human agents (Fischer 2010a; Nan 2011; Volkoff et al. 2007). These routines mirror the utilitarian, affective, and legal functionalities inscribed into the artifactual agents of the system by software designers (Giaccardi and Fischer 2008; van Schaik and Ling 2011; Volkoff et al. 2007). The utilitarian elements actualize the real-world activities and the system's processing functions responsible for accomplishing task-oriented goals (Germonprez et al. 2011; Volkoff et al. 2007). The task-oriented goals from the onset must also align with the business routines, industry standards, and practices. The affective elements cover the overall pleasant experience of the system and endorsement of aesthetic value (Olsson et al. 2013b; van Schaik and Ling 2011). The legal elements capture the inscribed rules, policies, and laws that govern the business practices and form the system's security standards. The embedded routines or structures at this time capture the designers' perceptions and reflect the features and the standard operating procedures of the system at the user interface (Shiang-Yen et al. 2012).

On the other hand, the meta-design concept of under-design captures the user's act of taking the embedded structures/features which are not faithfully enacted during usage practice (under-design) and situationally adapting them for personal relevance (Fischer and Herrmann 2011).

The recursive intertwining of embedded structures, as portrayed by CAS theory (Davis et al. 2007; Gell-Mann 1994), and its under-design processes of meta-design theory (Fischer and Herrmann 2011), can also be fleshed out with reference to Volkoff et al. (2007). Volkoff et al. (2007) distinguish between the ostensive and performative aspects

of routine in IT embeddedness, which must interweave in order to effect organizational change (Volkoff et al. 2007). The structures of IT are considered as the ostensive view of a software inscription process, whereas the performative practices of users enact such embedded structures to actualize task-oriented goals, as in repurposing the technology (Salovaara et al. 2011; Volkoff et al. 2007). At this point, the technology is viewed as being in a perpetual beta version (Fischer and Herrmann 2011). However, it manifests persistence, preserving the previous state, on which later adaptations can be built, in order to facilitate its emergent usage (Dix 2007; Dourish 2001).

Embedded IT artifacts influence and guide what emergent actions ought to be taken. While doing that, they put conditions on users' task performances as well as enforce security compliance. Widgets on the mobile device interface act as exemplary seeds, with infinite possibilities for use by customers. Thus, users operate under open under-development structures to embed, among others, multimedia annotations such as emoticons, local practices, and needs into their separate contexts-of-use. The under-design process allows them to transcend the functionalities and contents of an existing system. By doing this, features in the users' space are enhanced, failed functions are surreptitiously amended by the designers to set a new standard for users, while the technology evolves and adapts for new and different uses (Germonprez et al. 2011).

7.4.2 Organizational Structure

Organizational structure refers to how individual and team work is coordinated within an organization. For emergent usage of IS to be effective, the adopting organization must adjust a structure that will be consistent with the technology's adaptive nature. Since the organization is a service-mediated organization (Neumann et al. 2014), a flexible flat structure captures its operations, in order for them to achieve innovativeness (Baskerville et al. 1992; Mitleton-Kelly 2003; Patel 2012). Evidence of such operations are highly obvious in IT service-system organizations such as Google or e-commerce portal companies that typify the study context (Patel et al. 2010). Structures and leadership strategies in such organizations mimic some elements of complex adaptive system behaviors (Mitleton-Kelly 2003; Patel et al. 2010; Uhl-Bien et

al. 2007). Their behaviors evolve and produce emergent properties in their situated environments, to confront business volatility (Patel et al. 2010). Such an organizational structure can facilitate individual emergent use of the technology by linking macro- and micro-agents, as explained by CAS theory (Nan 2011; Yonggui et al. 2011).

Three dimensions are frequently used to describe such a structure: (1) fluid routineness, (2) diversified expertise among organizational team members, and (3) agile responsiveness (Alaa 2009; Gebauer et al. 2010; Lee and Xia 2010; Mitleton-Kelly 2003; Patel 2012; Patel et al. 2010).

Fluid routineness cultivates collaboration and communication among teams in the organizational structure. It accommodates adaptive business process and self-organized leadership style. Such a leadership style is driven by a common goal (Alaa 2009; Mitleton-Kelly 2003). Also, fluid routineness relates to the ease of handling exceptions and the novelty with which managerial decision-making is programmed to embrace adaptation in problem-oriented action (Gebauer et al. 2010; Patel et al. 2010).

Diversity of expertise among team members reflects the varied domain expertise that such a structure holds with diverse competencies of software designers. Based on this, learning and innovation are stimulated, alternative solutions are encouraged, and diverse knowledge-bases are accessible to support novel usage of the technology (Lee and Xia 2010). Harnessing these advantages facilitates acquisition of new expertise to confront user requirement changes.

Agile responsiveness involves the timeliness and minimal cost required to handle requirement changes or resolution of any dysfunctional part of the system while-in-use (Lee and Xia 2010). It also captures the effectiveness of engaging employees' expertise to resolve task problems for achieving excellent service delivery (Lee and Xia 2010; Zhang et al. 2011). Because of such a structure, software designers easily rally around software errors regarded as viable sources of learning, with free flow of collaborative ideas to trigger change-oriented actions (Iivari 2006; Magni et al. 2010; Patel and Hackney 2010). They are also poised to develop and sustain IS solutions that are

reflective of the current and unanticipated needs of users. Consequently, the roles of software designers become adaptive in encouraging the repurposing of the technology by users (Alaa 2009; Lee and Xia 2010; Salovaara et al. 2011). The actions of the designers – which are also shaped by organizational structure – then begin to make sense in influencing individual technology adoption and appropriation outside the organization (Magni et al. 2010; Salovaara 2008).

7.4.3 Information Asymmetrical Structure

In a CAS environment, interactions are adaptive and non-linear with asymmetrical flows of information (Cilliers 1998). Such information flow results in an asymmetrical relationship that fosters a one-sided power relationship. The dominant party can exploit such relationships to create sub-optimal behavior such as moral hazards (Barbaroux 2014; Cilliers 1998). Moral hazards exist when, in a business relationship, the dominant party makes decisions for their own benefit without the lesser party's consent (Engelen et al. 2010). The CAS theoretical notion of asymmetric information is different from the theory of information asymmetry in economic transactions, where dishonesty in economic markets is triggered by individuals/groups for each other's exploitation (Akerlof 1970). Asymmetrical information in CAS is seen as a means of creating action possibilities for adaptation, to combat species dominance (Cilliers 1998). When applied to organizational leadership, such dominance is called authority-based (Uhl-Bien et al. 2007).

Authority-based asymmetric information for excising dominance is at the heart of financial institutions, especially banks (Engelen et al. 2010), and varied technologies are enacted to further reinforce it. Most times the information needed by customers is intentionally censored (Hedvicaková and Soukal 2012; Kajtazi et al. 2011). This equips one party (in this case the banks) with more or better information. Such information is used to dominate in situations of transactions, negotiations, or communications with another party, in this case the less informed customers. Asymmetric information is evident in how difficult it is at times for customers to ascertain the cost of bank services,

because of unclear and nontransparent tariff structures of their e-products (Hedvicaková and Soukal 2012).

Exploitation of asymmetrical power occurs where contractual information is less explained or intentionally censored prior to acquiring account services, only to be explained when there is a default by less informed customers (Engelen et al. 2010; Kau et al. 2012). Other potential forms of exploitation include the misuse of customer information for unethical behavior and securitization of mortgage loans without the borrower's consent, among others, which led to the global financial recession (Brent and Addo 2012; Engelen et al. 2010; Kau et al. 2012). Thus, the CAS asymmetric information concept (Cilliers 1998), and the organic linkage CAS hold for micro- and macro-structure, help explain how users derive novel uses of technology as new service opportunities to confront information asymmetrical structures of banks.

The technology is designed to monitor and track any activity on a customer's account. Therefore, to ascertain varied costs of services and to compare prices, users customize the technology to render different presentations of their account's transaction patterns that have often been censored by the dominant class, i.e., banks. Such a presentation empowers users of the technology, who are also customers of banks, to understand how changes in institutional structures influence their individual financial behavior, as they engage in self-audit preparedness to confront such changes. Because two individuals in relation do not possess the same – exhaustive and complete sets of – information (Barbaroux 2014), the lesser (in this case the customer/user of the technology) appropriates the technology and creates innovative entrepreneurial discovery to manage such relations (Cohen and Winn 2007). Moreover, since the technology is both mobile and social, with seamless integration of pedagogical features to address customer financial needs, such technology has empowered self-directed customers to rely less upon traditional sources of financial advice, which most times are skewed towards institutional advantage.

7.5 Dynamic Mechanisms

By integrating the conceptual framework developed in this study with theories of CAS and meta-design in the light of the initial empirical evidence, the following dynamic mechanisms are identified.

7.5.1 Misfits and Ease-of-Workarounds

The concept of misfits and workarounds are rooted in CAS theory (Eidelson 1997; Schilling 2003; Uhl-Bien et al. 2007). Misfits in agents' interactions are renamed here as innovations that can lead to a better problem solution, or a more adaptive path (Eidelson 1997; Schilling 2003). Thus, a CAS adapts or evolves, shifting in response to changes in context, or to changes in underlying components, to confront misfits, or for the pursuance of a 'better fit' (Alexander 1964; Holland 1994). In a CAS environment, workarounds also exist in response to misfits, since there is never a flawless relationship between the social (human) and the technical computing (task processes) (Alter 2014; Schilling 2003).

By drawing from the CAS metaphor of misfits and workarounds, system misfits and workarounds can be viewed as a set of mechanisms that evoke emergent usage of adaptive IS under study. System misfits are taken to be the *apperceived* mismatches between task requirement changes and the functional capabilities of the technology. Users' apperceived misfits are aroused when a system is used, but falls short of user expectations. Such misfits do not affect the performance of the system. Rather, they trigger user tinkering, or sense-making, with the aim of adapting or circumventing such misfits and achieving the envisaged value from the system.

Misfit between IS and individual context-of-use has been a central concept in the IS field as captured by task-technology-fit (TTF) theory (Goodhue and Thompson 1995). The fundamental premise of TTF-based studies is that IS can have a better or worst fit with tasks and therefore ensuring system's fitness is a desirable pursuit. Presently, there is a longstanding belief among several IS theorists (e.g., Barki et al. 2007; Gebauer et al.

2010; Goodhue 2006; Goodhue and Thompson 1995; Shiang-Yen et al. 2012) that when components of an IS fit well with the task, the system functions effectively, achieving desired performance. Goodhue (2006) summarizes this assumption by saying that: “*a technology can only have positive performance impacts if it ‘fits’ the task that is being supported*” (p.10). The ubiquity of adaptive e-financial service-systems and their emergent usage has challenged this assumption. CAS theory explains how misfits at the edge of chaos are desirable and, in fact, can be cultivated to some extent in the system’s design and functionality (Schilling 2003; Vidgen and Wang 2009).

Interesting behavior occurs in IS innovation at the edge of chaos (Wang and Vidgen 2007), “*where life has enough stability to sustain itself and enough creativity to deserve the name of life*” (Waldrop 1994, p. 12). Paradoxically, the duality of stability and instability exists in a dynamic fashion at the edge of chaos and adaptive IS is situated in this region for survival (sustainability), a requirement for the emergence of novel behaviors (Wang and Vidgen 2007; Wilson and Holt 2001). Thus, users utilize workarounds to resolve and navigate around this region of misfit, to better align the system with their task practices. By doing this, the system adapts purposefully, when users alter the system to seek more enhanced value outside the default design (Alter 2014; Schilling 2003).

The system can also shift its structures because of the environment selected for a particular attribute, as in the case of location-aware functions of the mobile-IT artifact under study (Gebauer et al. 2010; Xu et al. 2011). By doing so, the context creates enormous power that draws the system towards a particular state conducive for the user to adapt and meet contingency needs or idiosyncratic requirements. Due to the modularized nature of the system (Guoliang and Tao 2010; Valdes et al. 2010), such adaptation resides only within the user space. It does not penetrate into the deep structures (Wand and Weber 1995) and hence cannot be generalized to all other users of the system, except as prompted by the designers (Joachim et al. 2013; Simon 1962).

Workarounds occur in a variety of forms and could be beneficial within the confines of the system’s governance and users’ allocated space. They can also be harmful if they are

unethical and illegal; security sophistry would have to be deployed against such (Alter 2014). A variety of definitions accompany workarounds (Alter 2014). However, the definition adopted in this thesis is where there is *apperceived* misfit and users adapt, appropriate, or even deviate from the system's configurable settings or task requirements to meet their expectations within their own user space. Task-technology misfit with ease-of-workarounds continues to provide high valence for emergent usage of IS innovation (le Roux 2014; Shiang-Yen et al. 2012). Although such a phenomenon is not sufficiently captured in IS literature (le Roux 2014), it is recognized that planned and emergent duality of use, where emergence is enforced by misfits exist, and systems circumvention, become apparent. Consequently, user experiences accumulate to generate a greater urge to immediately pursue workarounds or circumvention options. Such workarounds/circumventions are done to meet personal relevance and compensate for what users might consider as deficiencies within the system (Alter 2014; Boudreau and Robey 2005; le Roux 2014).

7.5.2 System Affordances

System Affordances can be taken to be generators of emergent usage of IS. Affordances are mechanisms that exist because of the relationship between the intuitive features of IS – which allow us to directly, and correctly, *see* what we can do with such features – and the capabilities of users in the technology's environment (Markus and Silver 2008; Volkoff and Strong 2013). The increasing use of affordances in IS use stems from the ecological framework of Gibson (1986). Gibson's type of affordances, when applied to IS, explains the direct perception of possibilities for action, or strong visual clues to the operation of things integrated in IS design features (Kaptelinin 2013; Volkoff and Strong 2013). Similarly, CAS theory situates the concept of affordances within an ecological framework of Gibson (1986) who invented the term (Holland 1996; Nye and Silverman 2012). CAS theory, in its sense of self-organization, intuitive interaction, adaptation, and diversity, incorporates affordances to explain the survival of heterogeneous actors, by their ability to adapt to changes as they interact with object features they mentally pick up in their environment (Holland 1996; Nye and Silverman 2012).

Despite various radical views of the concept of affordances (see Boyle and Cook 2004; Vatrapu 2010), affordances in the theorization of this study are aligned with Gibson's relational concept of affordances, as endorsed by CAS theory (Boyle and Cook 2004; Chemero 2003; Holland 1996). Gibson's approach strongly supports the essence of the object (in this case technical) that provides the potential utility of an object, i.e., the actions it affords for the user by reason of its nature or embedded properties during design (Markus and Silver 2008; Vatrapu 2010). The potential utilities of the object are what the said object exudes to its environment, in the form of information that a user actively or directly perceives or picks up (Volkoff and Strong 2013). Thus, Gibson's view is congruent with critical realist assumptions (Boyle and Cook 2004; Volkoff and Strong 2013). Technologies change the habitat in which people live due to their very nature, and the new habitat affords new ways of doing things that allow users to adapt more effectively to new opportunities (Boyle and Cook 2004). Thus, affordances are product-in-relations, because of the interactions between an actor, the object, and its environment. Seeing affordances as product-in-relation prompted Markus and Silver (2008, p. 622) to classify affordances not as technical properties, but "*the possibilities for goal-oriented action afforded to specified user or user groups by technical objects*".

There are reasons for the relevance of affordances in explaining emergent usage of IS in the study context. The software artifact under study is not just used, but is designed, for particular uses, and with users 'in mind', though such use can never be fully anticipated at design time. Thus, its uses are seldom exhausted and, by the system exuding affordances as features, users pick up this information as action possibilities, to create different uses via the widgets (Leonardi 2013b; Volkoff and Strong 2013). However, the ability to actively pick up the information exuded is dependent upon the meaning the technical objects/features place on the intended user, which might not necessarily match the meanings attached to the features by the designers (Greenhalgh et al. 2004). Markus and Silver (2008, p. 623) classify such meaning as "*symbolic expressions*" defined as "*the communicative possibilities of a technical object for a specified user group*", due to the ability of the technical object to act as a sign that could be interpreted, and reacted to differently, by users.

In adaptive IS, which is the study context, affordances and their associated meanings and values are inseparable from the technical objects. Therefore, it is not easy to isolate symbolic expressions from affordances; for this reason, both affordances and symbolic expressions are treated as affordances (Strong et al. 2009). Thus, affordances are achieved by the selection of some of the features of IT, in relation to some of the properties of the users to actualize task accomplishments (Leonardi 2013b). Such affordances are based on the technology's persuasive design-in-use features that convey convincing user engagement, security, transparency, and utility. The properties of the users which are inherent in relation to affordances are the capability or aptitude of the users of the system (Greeno 1994; Strong et al. 2009). Both affordances and capability are fundamental and neither affordances nor capability are specifiable in the absence of specifying the other (Greeno 1994; Volkoff and Strong 2013).

In the IS field, capability or aptitude of users is mostly specified as **personal innovativeness in IT (PIIT)** (Agarwal and Prasad 1998; Thakur and Srivastava 2014). The concept of PIIT could also be supported by CAS theory, where agents' (human) interactions come to be by their cognitive structure and innovativeness, in relation to the action possibilities of the IT artifact as the object (Cilliers 1998; Nan 2011). Therefore, PIIT is considered as a contingent condition upon which affordances can be actualized (Strong et al. 2009), not as a variable that moderates the relationship between perceptions and behavioral intentions to adopt a new IT (Agarwal and Prasad 1998). PIIT does not on its own constitute the ultimate consequence; it stems from a personality trait, to capture humans as creative social actors with strong cognitive abilities with the technology (Nan 2011; Strong et al. 2009). The creativity here is a crucial component of PIIT, evident at the beginning of an IS innovation process, when ideas and performativity are generated to exploit the innovation in response to a perceived need (Agarwal and Prasad 1998; Strong et al. 2009). Because it stems from cognitive structures in which an event could take place, PIIT must be considered as bearing causal powers that link thoughts to actions in the technology (Bhaskar 2008b; Wynn and Williams 2012).

In the study context, potential affordances exist in multiple forms (Leonardi 2013b; Volkoff and Strong 2013), such as *service value creation affordances*, *visualizing affordances*, *categorizing and budgeting affordances*, *online banking affordances*, *pedagogical affordances*, *mobility affordances* and many more. *Service value creation affordances* reflect the possibility of innovative remixing of the features of the technology by the users to create their needs. For example, mashing up a location widget with Google Maps helps find the nearest ATM and branches of banks, irrespective of geographical location in South Africa. *Visualizing value affordances* signals the user's possibility of observing the different account activities in one dashboard, irrespective of where the transaction occurs. *Online banking affordances* offer the chance to totally manage every account (credit card, checking, savings, mortgage, investment, and retirement) through the technology, irrespective of the banks/financial institutions that house the physical money deposits. The interactive chatbots feature affords an embodied pedagogical agent who can answer questions and assist in simulating intelligent financial conversation with humans in the technology. *Mobility affordances* give users the perceptive-action that shows the totality of user financial behavior and banks' behavior, while on the move. Various affordances of these IS capabilities become appropriated as alternative technologies-in-practice for multiple purposes to suit contingencies of the moment.

7.5.3 Technological Cognizance

Just because an action possibility is included in the technology by reason of design, does not mean that users will choose to perform that action (Whatley and Dirckinck-Holmfeld 2010). Being reflexive agents with intentionality (Archer 1995), users can focus on mental modeling of what an interface communicates, based on their prior knowledge of technology capabilities, its features, potential use, costs, benefits, and continuous learning, to adapt the technology in deviance to designers' intent (Nambisan et al. 1999; Tai and Ting 2011). Nambisan et al. (1999) term such mental modeling as technological cognizance, classified as critical for acquiring or creating the knowledge know-how related to IS adaptation.

By drawing from diverse agents who learn and update their schemata as specified in CAS theory (Jordon et al. 2010; Nan 2011), technological cognizance can be seen as a mechanism that generates emergent usage of adaptive IS under study. CAS theory calls attention to the cognizance of diverse agents in generating varieties of creative and flexible responses through tinkering and learning, thus increasing the resilience and robustness of the service-system (Jordon et al. 2010; Nan 2011; Vargo and Akaka 2012). Learning here is agents' engagement in information processes and exchanges in the technology, to enrich the individual interpretive/cognitive flexibility, defined as mental endowment, of the varied uses of the technology across contexts (Orlikowski 1992). Such an interpretive flexibility is influenced by the characteristics of the *“material artifact”*, of *“the human agents”* and of the *“[situated] context”*. The interpretive flexibility in turn influences the *“degree to which users of a technology are engaged in its constitution . . . during use”* (Orlikowski 1992, p. 409).

Being not static entities (Archer 1995), human agents learn, and continuously change themselves, their relationships, and thereby change the system in which they are embedded (Jordon et al. 2010; Mutch 2010b). Inputs to such processed information can stem from accumulated knowledge from practice in a well-structured problem, or in an ill-structured problem that presents much more ambiguity and uncertainty. Thus, users create mapping-based cognitive processes to explain the discoveries of workaround-like appropriation, used in confronting the ill-structured problem or unique needs in the technology (Nambisan et al. 1999; Salovaara 2008). The mapping-based cognitive processes apply to the understanding of the inner workings or *“a rich and elaborate structure, reflecting the user's understanding of what the system contains, how it works, and why it works that way”* (Carroll et al. 1987, p. 12). By this, individual users build hypotheses as attunements to situational constraints witnessed in the technology (Greeno 1994; Salovaara 2008). By creating mental representations through these hypotheses, users create solution schemas about novel ways of using the technology (Greeno 1994; Salovaara 2008). Such hypotheses, when actualized in practice, build up rich mental cognizance, being the foundation for creativity; for, unless users understand the technology, the tasks involved, and the environment within which the system

operates, emergent usage of the technology will be dormant or will not likely be achieved (Nambisan et al. 1999; Salovaara 2008).

7.5.4 Trust-Distrust Dialectics: Bounded Trust

Drawing from the environmental uncertainty concept of CAS theory (Eidelson 1997; Nan 2011), it is postulated that the dialectical flux of trust and distrust can cause emergent use of the e-financial system. CAS theory is silent about trust or distrust. However, prior studies have emphasized that trust is an implicit mechanism of CAS theory (e.g., Alaa 2009; Curseu 2006; Kim 2009; Yonggui et al. 2011), for “*without uncertainty there is no need of trust*” (Iacobucci and Hibbard 1999, p. 23). Curseu (2006) draws from the emergence notion of CAS theory to argue that trust emerges from virtual teams’ effectiveness. Alaa (2009), by combining theories of CAS and social autopoiesis, explains that trust enables organizations’ emergent behaviors in an uncertain business environment. Kim (2009) draws upon uncertainty and intermediation notions of CAS theory to simulate the impact of trust on firms’ supply chain relation and decision-making behaviors. By such an agent-based simulation, uncertainties surrounding partners’ trustworthiness are confirmed to be the reason for trust (Kim 2009). Besides, since CAS theory organically links micro- and macro-properties, the interaction between an individual and uncertain socio-economic change in the organizations introduces trust in inter-organizational enterprise systems (Yonggui et al. 2011).

Particular to the study context, the socio-economic uncertainty is captured by the **situational abnormality and suspicion** existing in the e-financial ecosystem. As users utilize the technology, emergent usages that are triggered by the dialectical flux of trust and distrust are enacted, to mitigate the situational abnormality and suspicion (Moody et al. 2014; Pavlou et al. 2007). Hence, it is postulated that situational abnormality and suspicion are enabling conditions for the dialectical flux of trust and distrust to be activated in the e-financial system.

Trust holds various definitions in online contexts (Moody et al. 2014). Trust is seen as a decision made by a truster to be vulnerable (Mayer et al. 1995; McKnight et al. 1998), a psychological state of a truster (Rousseau et al. 1998), or both trust and distrust are known to be positive or negative expectations respectively (Lewicki et al. 1998; McKnight et al. 2004). In all these definitions, one thing common is that trust and/or distrust exist(s) in order to mitigate behavioral uncertainty and vulnerability in truster-trustee relationships (Moody et al. 2014; Pavlou et al. 2007). Thus, to flesh out the concept of dialectics of trust and distrust, Lewicki et al.'s (1998) definition of trust and distrust is drawn upon. This definition is also argued by Komiak and Benbasat (2008) as adequate in e-commerce contexts. Lewicki et al. (1998) define trust as “*confident positive expectations regarding another’s conduct [or e-commerce system’s functionalities]*”, and distrust as “*confident negative expectations of another’s conduct [or e-commerce system’s functionalities] that manifest themselves in fear, vigilance or suspicion*” (p. 439).

Komiak and Benbasat (2008), citing Lewicki et al. (1998), argue for co-existence of trust and distrust as two distinct entities in interaction, which need not be in balance or even consistent with each other. Such an interaction is what is considered as the dialectical flux of trust and distrust (Kupreychenko 2013) which can regulate two-party relationships. In such an instance, one party holds conflicting views about the other party, because trust can develop in some facets of the relationship, while distrust develops in other facets of that same relationship. Thus, the dialectical flux of trust and distrust in user-system interaction could give rise to ambivalence or “*bounded trust* i.e., ‘*trust but verify*’ . . . *where the level of distrust tempers the boundaries on the level of trust*” (Benamati and Serva 2007, p. 172; Moody et al. 2014).

Bounded trust amplifies the fact that a user approaches the technology in question with the expectation of private benefits, but with concerns about the perceived vulnerabilities that such an approach creates (Kupreychenko 2013; Moody et al. 2014). Emergent usage of the technology is therefore conditioned to the vagaries of positive interactions, when trust is engendered and restricted where distrust is present (Benamati and Serva 2007). Also, when the dialectical flux of trust and distrust is skewed towards a higher level of

trust, trust could be dysfunctional, or when such a flux is tilted towards distrust, distrust can be functional and helpful in keeping away from taking unnecessary risks (Benamati and Serva 2007). Consequently, users hold varied and conflicting positions regarding the technology's service offerings (Benamati and Serva 2007) in the presence of situational abnormality and suspicion (Moody et al. 2014).

Situational abnormality is the occurrence of an event that constitutes a social deviance from the norms in an environment that promotes expectations of trust, especially in an e-financial service-system (Benamati and Serva 2007; Moody et al. 2014; Schul et al. 2008). Such a social deviance produces an event that is somewhat novel to people who do not have previous experience and knowledge to draw upon to guide attitudes or behaviors (Schul et al. 2004, 2008). Being a disruptive technology (Lyytinen and Rose 2003), its emergence is distinctly different and, as such, creates situational abnormality in the online banking environment. In such a situation, people give up routines, attitudes, or behaviors which are no longer helpful. Instead, they resort to acquiring information in the form of discriminative encoding and process it for understanding the new situation (Schul et al. 2008).

Discriminative encoding, which is synonymous with meta-design theory's notion of critique systems (Giaccardi and Fischer 2008; Kelley and Michela 1980; Moody et al. 2014), refers to an intermittent encoding and processing of information for constructing alternatives, motivations, and interpretations to deal with the abnormality. The said alternatives constructed are called counter-scenarios, created in an attempt to understand what motivates others to use the technology, including their possible hidden motives. The said alternatives people construct can also lead to a temporary confidence expectation that is mixed with fear, wariness, skepticism, and vigilance. Thus, the truster (i.e., potential user) utilizes distrust for *isolation and self-preservation* (Kupreychenko 2013), while deducing the behavior of others in the technology. Moreover, it is obvious that such abnormal situations engender suspicion since it is different from the norm and, as such, people are likely to be vigilant and wary of the new environment (Gurtman and Lion 1982; Vlaar et al. 2007). Suspicion, given an abnormal situation, occurs when people actively engage multiple and rival hypotheses regarding

the intentions of another's behavior that prevents them from taking either a positive or negative stance towards the e-financial service-system at that particular time (Kramer 1999; Moody et al. 2014).

7.5.5 Technology Mediation

The mechanisms proposed so far are functional mechanisms since they constitute the causality needed to achieve emergent IS usage and, therefore, need to be enabled. However, such mechanisms might be activated, but neutralized by dysfunctional or “*countervailing mechanisms*” (Miller and Tsang 2010, p. 145). By drawing from the dyadic interaction between two human agents mediated by a non-human agent in CAS theory (Mingers 2014; Nan 2011), it is postulated that a technology mediation mechanism is a dysfunctional mechanism in the study context. Zhu et al. (2010a, p. 121) define a mediation mechanism “*as a process in which two or more human actors are but in relation by a third agent, the mediation agent, which supports them in reaching a common understanding related to a specific domain*”. In the study context, the third agent is the technical object seen as the personalized IT agent exchanging messages between two actors in the same e-financial ecosystem. The two actors are: (1) organizations that set-up the website and (2) its users. By this, technology mediation captures the role of technology in human actions and experiences to endorse normative human-computer relations (Bozdag 2013; Verbeek 2006a).

Because the mediation agent is scripted by humans to drive this human-computer relation, there are possibilities of such agents working for organizational advantage. At this point, the mediators provide users with interpretive resources to draw upon as they learn and adapt the technology. By doing this, they prescribe the actions of the users and their knowledgeability in financial structures, as well as understand users' practices over time. With these capabilities, the mediators become active, assume intentionality (Verbeek 2006a, 2006b), and could be used to provide biased financial product recommendations to serve the interests of the institution that made it available for use (Bozdag 2013; Verbeek 2006b).

As an active mediator, the technology has the ability to dynamically adapt its behaviors to the users. Through active mediation, the autonomous IT agent can manipulate financial data according to the specification of the user, to align with the system's advisory role. Thus, the degree to which the technology could aid individual users to make quality financial decisions depends on the veracity of the personalized IT agents (Xiao and Benbasat 2011). However, biased decision-making processes might be evident, since the competence of the systems in financial structures far exceeds that of their individual users. Besides, the intentionality of these technical mediators could be directed to specific aspects of reality to shape users' perceptions and interpretations accordingly (Polites and Karahanna 2013; Verbeek 2006a). Thus, they can amplify some specific perception that drives organizations' profitability and opportunistic behavior, while reducing others (Bozdag 2013; Verbeek 2006b). As such, the IT agents provide a specific basis for interpreting what is perceived (Verbeek 2006b). By doing this, the technology assumes the role of a persuasion agent, by shaping experiences and interpretations to inform human actions (Verbeek 2006b).

In this study context, the embedded IS agents, as active mediators, have helped to develop new interpretations of e-financial products, which inform and radically change people's banking and investment practice. As persuasive mediators, the technology can force people to behave in specific ways in a democratized information environment (von Hippel 2009); for instance, advocating online loan applications with fee reduction incentives, which might not be favored by the older affluent who are usually suspicious of new e-financial innovation (Asmi and Ishaya 2012). Besides, it could be used to persuade users into specific actions such as accepting a promoted financial product as the '*best next product-to-buy*', while the organization does so in order to increase the chance that consumers will choose that particular product (Verbeek 2006b; Xiao and Benbasat 2011).

7.6 Control Mechanisms

Subjecting the initial empirical evidence within the prism of self-reinforcing/historicity in CAS theory or the critiquing concept of meta-design (Deacon 2006; Giaccardi and

Fischer 2008; Mingers 2014), it is postulated that critiquing, reflection, and learning are a set of control mechanisms operating in the study context. The historicity in CAS theory shows how the parts have been revised due to interactions from the past, to situate the system in the present context of its environment (*i.e.*, “*the response function depends on a history of transactions*”) (Clancey 1997, p. 280).

7.6.1 Critiquing, Reflection, and Learning

Critiquing, reflection, and learning are a set of mechanisms users engage with to evaluate their emergent uses, aimed at providing valuable contributions to designers to improve further re-use of the system (Giaccardi and Fischer 2008). Such a set of mechanisms is prompted by the causal efficacy of the emergent usage outcomes being real to specify how higher-order states repeatedly shape the lower order dynamics of the systems’ micro-components (Deacon 2006; Mingers 2014).

In isolation, critiquing assumes the memory lane or path dependence that is of fundamental importance for deciding the next emergent usage (Deacon 2006; Giaccardi and Fischer 2008); it buttresses the fact that IS use is not static, but continually evolves with self-reappraisal of the situation (Beaudry and Pinsonneault 2005). Reflection and learning are then utilized by designers to confront users’ critiquing outcomes, by providing iterative post releases and continuous adjustment or reseeding to improve the usability of the system (Alaa 2009; Fischer and Herrmann 2011). Thus, it can be argued that individuals’ critiquing becomes the feedback mechanism a user engages with, to positively or negatively disconfirm the emergent IS usage outcomes (Giaccardi and Fischer 2008; Jasperson et al. 2005). Critiquing also provides the mechanism by which users assign meaning to the technology and how it affects their future re-use (Greenhalgh et al. 2004). In the study context, mostly for potential users, critiquing and re-use mechanisms are allowed to exist during the test-and-learn 30 days trial period, where users engage with the technology prior to formal signing in. As well, there is a click-to-chat feature for users to send their views to the designers while using the technology. Reflection and learning mutually reinforce social relationships and interactions among stakeholders in the technology. Reflection and learning are also

used to counteract any excessive tendencies of users to modify the system while-in-use (Fischer and Herrmann 2011). Reflective practice enables both designers and users to reflect on their actions and experiences in order to achieve learning, which is also consistent with reflection that makes that which was unknown known in the technology. Thus, it can be postulated that emergent usage outcomes lead to critiquing, reflection, and learning, as a set of mechanisms that can reinforce the existing structures and other mechanisms in triggering the new sequence of emergent usage of adaptive IS through feedback processes.

7.7 The Analytical Arm of the Theoretical Framework: Experiential Factors

By drawing from the conceptual framework in the light of the initial empirical evidence, the experiential factors can be postulated as that which describes the emergent UX of adaptive IS. The experiential factors are users' subjective experiences with the technology and can be summarized as factors that mostly relate to the system's functionalities, content, and interaction. Such factors are also concepts that hold on to the duality of rationality and emotional attributes in IS use (Avgerou and McGrath 2005; Hassenzahl 2003).

The next discussion will start with user empowerment as one of the key concepts.

7.7.1 User Empowerment

Empowerment refers to the process through which people, organizations and communities gain mastery over issues of concern to them (Li and Gregor 2011, p. 120). Information systems (IS) on their own do not empower or lead to empowerment (Psoinos et al. 2000). Rather, it is the experience users have in fulfilling certain responsibilities through IS as a creative tool that brings the empowerment (Olsson 2013; Psoinos et al. 2000). Such responsibilities include panoptic empowerment (Elmes et al. 2005; Kayas et al. 2008), reflective empowerment (Elmes et al. 2005; Kayas et al. 2008), autonomy, sense of control, and self-actualization (Olsson 2013; Pahlke and Beck 2012; Paternò 2013), adaptation, motivation, joyfulness, and achievement of

situational creativity, because of the functionalities of the technology (Fischer et al. 2004b; Olsson 2013; Pahlke et al. 2010; Paternò 2013). Somewhat similar to enterprise resource planning (ERP) systems, panoptic empowerment in the technology describes the one-way one-user visibility of account transactions, across the geography of financial institutions in one view, through the creation of e-dashboards (Elmes et al. 2005; Kayas et al. 2008; Pahlke et al. 2010). Based on this, reflective empowerment captures user engagement with the dashboard to take highly reflective decisions. By doing this, they acquire self-determination in investment planning and general understanding of their spending habits (Elmes et al. 2005; Kayas et al. 2008). Also, by engaging with the comparative matrix features of the service-system, the users are empowered to know alternative prices and services of other financial institutions (Gordon et al. 2010).

With empowerment for adaptations, a new set of self-directed users emerges who adapt the system to gain control of their financial behavior. Creativity experiences in the technology stem from the autonomy users are endowed with when using the widget icon to mash up different resources within the system, or from different web sources, to solve situational needs and the ecstasy derived in doing such (Olsson 2013; Pahlke and Beck 2012; Paternò 2013). Users' empowerment is also reinforced at the organizational level by the software designers, in that it controls the activities they pursue, their governance, and their administration. Thus, the technology's ecosystem often manifests key characteristics of empowering individuals as: (1) a belief system that inspires financial awareness focused beyond the self, (2) an opportunity for placing users as co-designers, since users see themselves as prosumers; and (3) a support system that is encompassing, engaging, and provides a sense of self-identity and self-recognition experience.

7.7.2 User Satisfaction

User satisfaction is defined as a subjective evaluation of positive interaction experience. It arises from a comparison between expectations and performance of the technology, in yielding to service needs or users' idiosyncratic requirements, in the very context of its usage (Hassenzahl and Monk 2010; Phillips and Baumgartner 2002; Scheepers et al.

2006). Satisfaction, being a key construct of ECM (Bhattacharjee 2001), is mostly operationalized, based on its functional implications (i.e., utility-based) (Bhattacharjee and Barfar 2011; Hung et al. 2011). Recent studies (e.g., Bassi 2010; Hassenzahl et al. 2010; Phillips and Baumgartner 2002; Scheepers et al. 2006) reveal that the experiential and contextual implications in user satisfaction must be accounted for when considering user satisfaction influence on user behavior.

Phillips and Baumgartner (2002) propose an experiential satisfaction response model to examine the role of consumption emotions within the ECM. Hassenzahl et al. (2010) also indicate that even though pragmatic qualities that focus on tasks maintain satisfaction, the hedonic qualities of the product or service are the ones responsible for the positive experiences of users. Thus, not only is the cognitive component geared towards technology's performance considered, but also all aspects which are linked to the context, emotional, and sensorial stimuli (i.e., the affective component). This view of user satisfaction has relevance in adaptive IS for e-financial services, because people do not merely use the technology; they interact and engage with the system to solve personal needs that might not be envisaged by the designers (Attfield et al. 2011; Partala and Kallinen 2012).

7.7.3 Perceived Deceptiveness of the System

Perceived deceptiveness captures users' experiences or beliefs framed without necessarily having sufficient evidence to warrant the certainty that the system's service offerings are being deceptive (Mavlanova et al. 2015; Xiao and Benbasat 2011). Formed by situational cues or preconceived negative expectations, users can trigger perceptions and feelings of deceptiveness in the content of the system. Such deceptiveness exists in a state of uncertainty as to the honesty of the service-system (Buller and Burgoon 1996; Xiao and Tan 2012).

Adaptive IS for e-financial services mostly undergo persuasive attempts in their service offerings (Charki and Josserand 2008; Verbeek 2006b). Therefore, perceiving and experiencing deceptiveness in such systems is feasible and it reflects users' concerns

about their self-susceptibility, including of other people, which may trigger corrective behaviors such as avoidance (Xiao and Benbasat 2011). A belief that the service-system has deceptive content evokes an intense feeling of disappointment, frustration, and anger in users, since their expectations about the organization and its e-financial web-portal are violated (Robinson and Morrison 2000). A total boycott of the system can occur, not motivated by the perceived effects of deceptiveness by the user, but by the perceived effects on others which can go ‘viral’ via social media.

Being a service mediating entity, manipulations may occur in the content, presentation, or generation of financial service information, leading to concealment, equivocation, and falsification, respectively (Charki and Josserand 2008; Xiao and Benbasat 2011). Thus, organizations that deploy the technology in alliance with regulatory bodies scrutinize the service offerings closely. However, perceptions associated with deceptiveness still exist in various forms and lead to profound consequences for both the organization and the consumers of such services.

7.7.4 Apperception of IS Usefulness

According to TAM, usefulness is perceived (Davis et al. 1989) as goal-oriented, free from context and emotions, situated in a static IS environment, to address intent that might not necessarily lead to actual usage (Bhattacharjee and Barfar 2011; Salovaara and Tamminen 2009). However, such a mindset is fast waning because new-breed IS incorporate contextual adaptations, and rational and emotional aspects driven by more of *apperceived* usefulness, rather than perceived usefulness. Apperceived IS involves sensory perception and subsequent sense-making of IS features, due to experiences from immediate or past user-system interactions (De Florio 2012; Saariluoma 2003; Saariluoma et al. 2013). Apperceived IS usefulness, therefore, corresponds to humans’ ability to make adaptive use of IS, by currently perceiving and using memory images of past experiences of its use, to achieve usefulness in a particular context-of-use (De Florio 2012; MacDonald and Atwood 2014). It includes the capability to construct theories, ideas and mental content about the current and related past situations with which to drive the system’s evolutionary growth while-in-use (De Florio 2012). Since an

IS partially constitutes the things to which it is applied (Polites and Karahanna 2013), it has become a constitutive and a configurational technology that shapes human practices in substantial ways. Context now becomes an emergent property of technology use and implies that a system is a tool that mediates, rather than determines, the context of human practices (MacDonald and Atwood 2014).

Information systems, when adopted, acquire different meanings in various contexts; the meaning creation is always dependent on contexts, which could be psychological, social, or cultural. People perceive and use the adopted system differently, due to their unique psychological make-up of varied past experiences and acquired knowledge. When such psychologically-based preconditions interact with the situational contexts of the technology, it generates apperceptions of usefulness that play a major role in describing emergent UX. At this point, IS usefulness is redefined as the “*extent to which a system’s functions allow users to complete a set of tasks and fulfill specific goals in a particular context of use*” (MacDonald and Atwood 2014, n.p). Thus, apperception of such usefulness stems from the mental content of past experiences of technology-use, relative to its context-of-use, to address idiosyncratic requirements of users or their cultural differences and values (Rousi et al. 2010; Saariluoma et al. 2009). From this perspective, relating usefulness to context seems obvious, as the system can only be considered useful if it fits into the context-of-use and/or reflects users' idiosyncratic requirements, and that can only be perceived while-in-use or thereafter. Thus, the process of apperception is constructed by the individual’s cognitive structures and emotions, with emotional valence (i.e., positive or negative) having a significant role, to unite the individual’s experiences (Haviland-Jones and Kahlbaugh 2000). In the study context, *apperceived* usefulness captures the simultaneity of the utilitarian and hedonic functionalities of the technology. It allows a user to complete a task relative to a particular context-of-use and the experiences encountered (MacDonald and Atwood 2014; Saariluoma et al. 2013). The utilitarian elements entail appropriateness of the system to the context, simplicity and ease-of-reconfiguration of the technology, whereas hedonic elements are visual attractiveness and pleasurable interactions needed for enjoyable interaction experiences, despite being a domain that is goal driven (Avgerou

and McGrath 2005; Li et al. 2012; MacDonald and Atwood 2014; Saariluoma et al. 2013).

7.6.5 Security and Privacy Concerns

Security and privacy concerns in the service-system are perceptions and feelings about the threat-prone functionalities in the system, with the potential to cause harm (Featherman et al. 2010; Yousafzai et al. 2009). Such threat-prone functionalities can come via denial of service, phishing attacks, unauthorized disclosure of users' captured data, and the non-repudiation of the already made transactions when in question (Featherman et al. 2010). While security risk focuses on the external abuse, privacy risk captures the insider abuse of the captured personal information. Thus, security and privacy are not intended to be separated, because security provides the technical guarantees that privacy regulations are met effectively (Casalo et al. 2007; McCole et al. 2009). Security breaches enable the unauthorized access and non-ethical use of consumers' confidential data (e.g., users' PIN numbers, credit card numbers, etc.,) and other insider abuse of such data that often result in identity theft, financial loss, and psychological harms (Chua et al. 2011; Featherman et al. 2010).

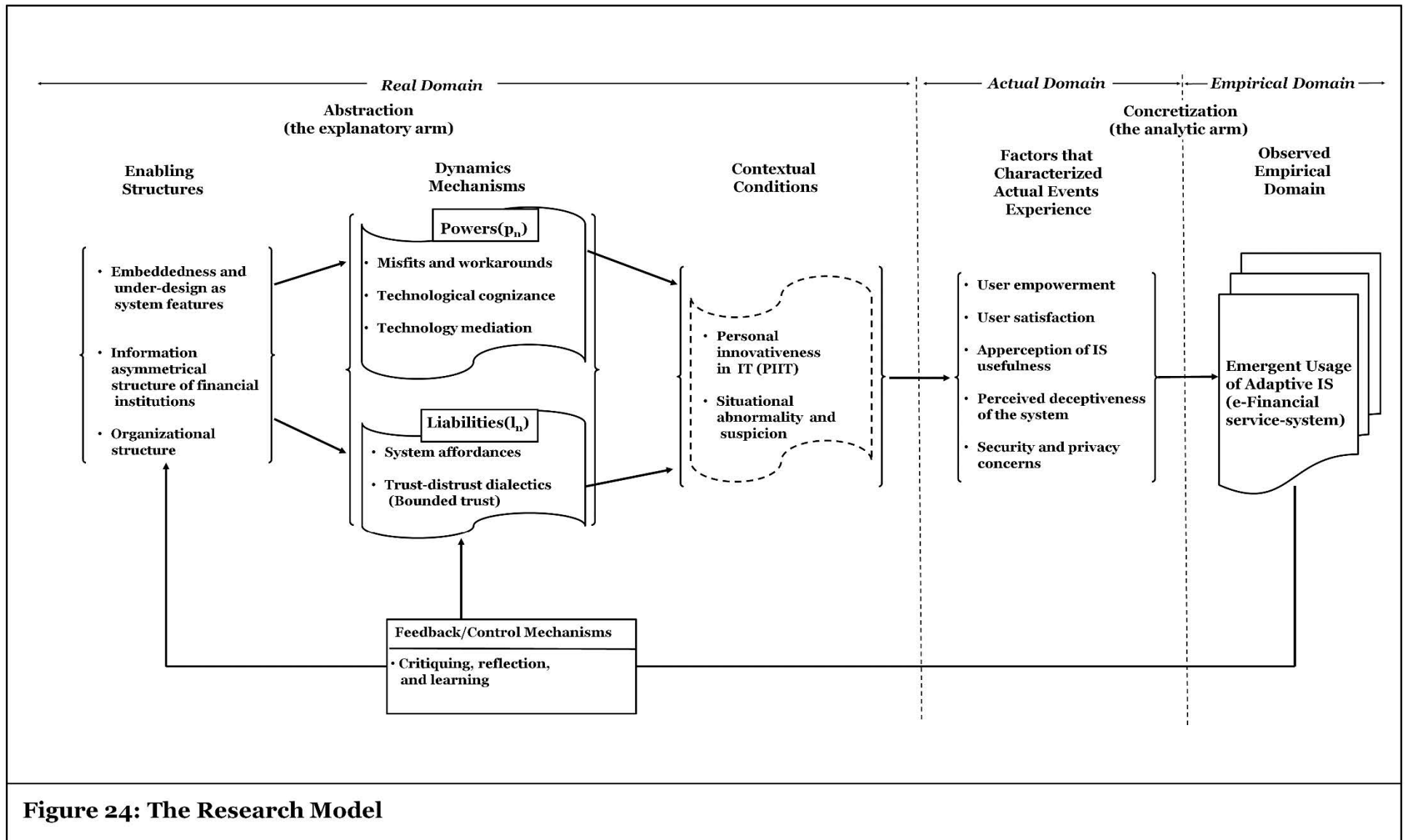
Although security and privacy breaches in e-financial activities are common, the technology's usage continues to grow among organizations and users. Thus, the potential intrusion of users' privacy becomes an apparent concern leading to cost-benefit analysis of using the innovation. The cost-benefit analysis has been termed by IS researchers as the personalization-privacy paradox (Awad and Krishnan 2006), which happens in the midst of an uncertain but valuable e-financial environment which can be used to personalize service needs. Privacy/security risk is defined as the users' subjective assessment of potential losses due to privacy and security breaches. Perceptions or experiences of such risks can generate anxiety that discourages technology use (Beaudry and Pinsonneault 2010). Although such concerns might not be generalized, most users will give up some of their personal information in order to receive the customized service experience afforded by the technology (Awad and Krishnan 2006).

Having postulated the generative mechanisms and the experiential factors, the next agenda in the theoretical redescription process is building the research model; this is done in the next section.

7.8 The Research Model

The theoretical redescription moves further towards specifying an emerging theory, using the postulated generative mechanisms and the experiential factors as building blocks and mapping out their relationships to form a research model (George and Bennett 2005; Shaw et al. 2007; Weber 2012). Following scholars (e.g., Easton 2010a; Zachariadis et al. 2013), the critical realist ontological framework of Sayer (1992) is used, as shown in Figure 24. While there is no claim to its exhaustiveness, the generative mechanisms and the experiential factors identified were selected based on the theory-empirical abductive matching process (Danermark et al. 2002; Trochim 1989). Such a process also enfolded the implication of using the judgmental rationality concept of critical realism in theory building, where mechanisms and factors were selected as the best explanation of the data i.e., grounding theory development empirically in the available evidence (Gregor 2009; Grover and Lyytinen 2015; Vega and Brown 2011).

As Sayer (1992, p. 86) would say, “*even when we are interested in wholes we must select and abstract their constituents*”. Thus, elimination of mechanisms/factors is done by using the mind as an experimental laboratory for social science. By doing that, accidental/non-plausible generative mechanisms and factors that were persistently not in corroboration with the preliminary empirical evidence were filtered out (Bhaskar 1979; Miller and Tsang 2010). In this way, this chapter addresses stage 3 and part of stage 5 of Danermark et al.’s (2002) model.

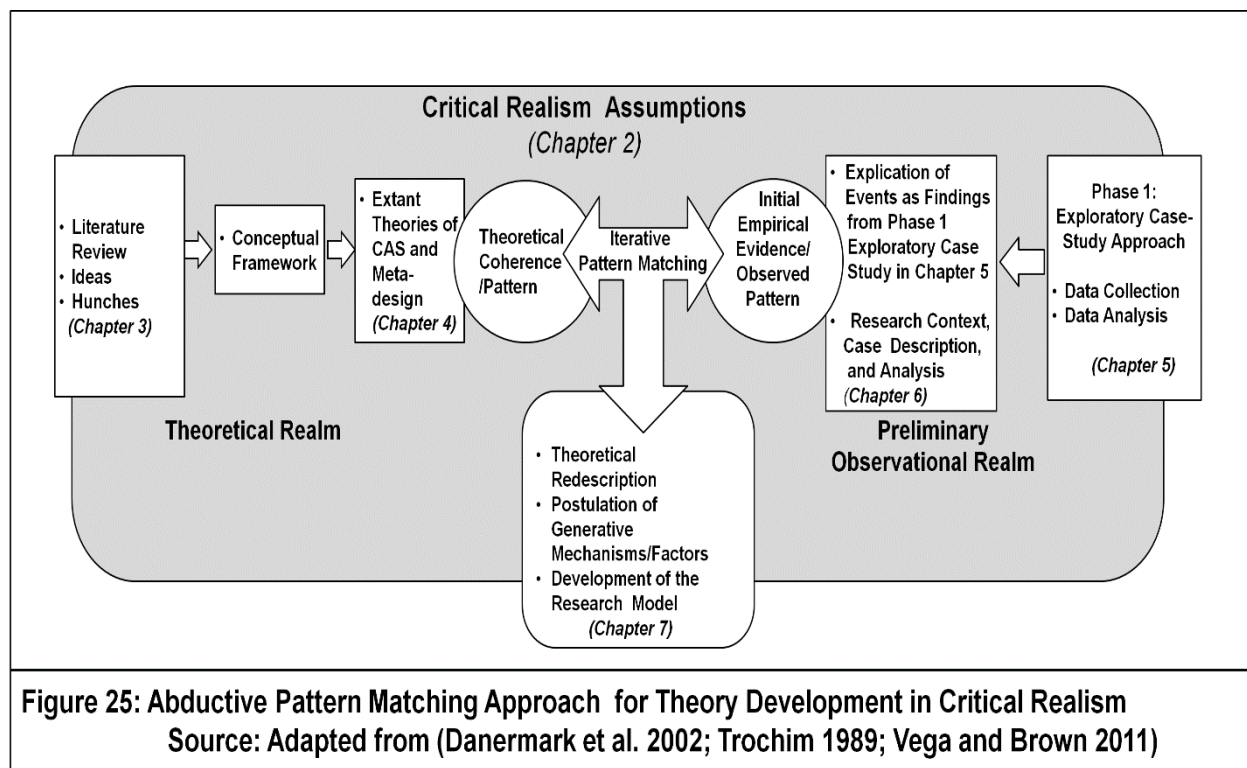


The research model reflects the coalescence of the analytical, explanatory, and ontological frameworks. It has both the explanatory arm and the analytical arm situated on a critical realist ontological premise. The analytical arm on its own is a typological theory with abstracted constructs in the actual domain. Such constructs manifest themselves as observable points of entry to exhume the generative mechanisms, using a retroductive approach (Mingers 2006; Vega and Brown 2011). They are used as factors to describe emergent IS usage, considered here as a multi-unidimensional construct at the empirical domain (Doty and Glick 1994; George and Bennett 2005). The feedback/control mechanisms (i.e., critiquing, reflection, and learning) show the congruence between critical realism and CAS theory's notion of reciprocal causation or self-reinforcement (Deacon 2006; Mingers 2014). The stacked boxes representing emergent use of adaptive IS in the research model indicate the high degree of context-sensitivity, as different users adapt, and adapt to, the same technology in different ways.

System affordances and bounded trust are shown as liabilities or passive powers, because they are susceptible to the powers of contextual conditions or other mechanisms for them to be activated or actualized (Judd 2005; Sayer 1992). In the IS field, liabilities may have been understood as causal powers with only negative valence (e.g., Zachariadis et al. 2013), which is not necessarily true, for they can also take on positive values or ambivalence. The concept of liabilities in critical realism is rooted in the assumption that some mechanisms with tendencies to actualize can only or fully do that in conjunction with other mechanism(s) or condition(s) they are susceptible to (Bhaskar 2008b; Judd 2005; Sayer 1992), not necessarily on the nature of the valence such mechanisms hold in that context (Fleetwood 2011). Thus, affordance mechanisms are assumed not to be actualized without PIIT (Strong et al. 2009). The same goes for bounded trust, for it cannot be activated without the significant presence of situational abnormality and suspicion (Moody et al. 2014).

7.9 Chapter Summary

This chapter illustrates how a critical realist explanatory theory that represented the research model is articulated. As Figure 25 attests, it started by the progressive move embarked upon from Chapter 2, where critical realist assumptions were explicated, to this present chapter that details the abductive pattern-matching process. Chapter 3 discussed the process of synthesizing existing knowledge, identifying research gaps, developing a critical realist conceptual framework, and proposing the research agenda.



However, “any analytical framework that characterizes an [IT] artifact’s role in human . . . [interaction] ought to be grounded in a theoretical perspective” that seems to explain its situated context (Hundhausen 2005, p. 156). Consequently, extant theories of CAS and meta-design were introduced in Chapter 4. The exploratory case-study design that highlighted the initial empirical evidence of the technology’s situated context were introduced in Chapter 5. Chapter 6 discussed the findings of the exploratory case-study in the form of research context, case description, and analysis. Both Chapters 5

and 6 provided the preliminary observational realm. Using the conceptual framework synthesized from literature as a starting point, theories of CAS and meta-design were integrated to develop the theoretical realm. The theoretical realm is matched with the preliminary observational realm that holds the initial empirical pattern, by means of theoretical redescription or re-contextualization (Danermark et al. 2002; Grover and Lyytinen 2015; Trochim 1989). Thus, as Figure 25 also attests, pattern matching is an abductive attempt to link theoretical patterns with initial observable patterns to develop a complex embryonic theoretical model (Grover and Lyytinen 2015; Pawson and Tilley 1977). Such a model seems to explain the observed empirical pattern in the light of critical realist assumptions (Trochim 1989; Vega and Brown 2011). Based on the model, mechanism-based hypotheses aimed at pushing forward a future research agenda were postulated (Mingers 2006; Schryen 2013).

Similar to Dobson et al.'s (2013) confession, critical realist theory building is seen in this thesis to be very challenging and time consuming. It requires “. . . *a non-traditional approach to research as theories are frequently examined and discarded based on their explanatory power*” in the light of the initial empirical evidence (p. 971). Being a creative and highly iterative process, critical realist theory building “*depends upon a rare blending of intellectual, practice-technical and perceptual skills* (Bhaskar 2008b, p. 37). According to Bhaskar, “[t]his is the arduous task of science: the production of the knowledge of those enduring and continually active mechanisms of nature that produce the phenomena of our world” (Bhaskar 2008b, p. 37).

While most of the existing research paths are aligned with variance theories of independent and dependent variables, the research model paths in this study are linked to system theory, which targets dynamic, emergent processes of mechanism interaction with reciprocal causality (Burton-Jones et al. 2014; Mingers 2014). Since scientific theories do not stand on their own, but correspond to some aspect of the world around us (Bhaskar 1986; Peacock 2000), the next move, therefore, is to engage with the explanatory case-study research phase, to see how far the *embryonic* research model further corroborates with the empirical evidence, in order to further refine the model (Wynn and Williams 2012).

Chapter 8

Phase 2 Research Design and Methods: Empirical Corroboration

“The next stage is to collect data that will allow interrogation of these embryonic hypotheses.”

(Pawson and Tilley 2004, p. 10)

8.1 Introduction

This chapter discusses the empirical corroboration phase of the research project. The structures, mechanisms, enabling conditions, and the experiential non-causal factors proposed through the retroductive process in the preceding chapter are hypotheses. Such hypotheses are encapsulated in the form of the research model and are tentative in nature. Empirical corroboration, defined as the process of comparing the hypothesized generative mechanisms/factors with data, can be taken as a process used to validate the research model (Wynn and Williams 2012). By doing this, the causal depth and explanatory powers of the causal mechanisms can be verified as explaining the outcomes. Bhaskar (2008b, p. 4) likens empirical corroboration to the process *“in which the reality of mechanisms postulated are subjected to empirical scrutiny”*. Empirical corroboration is also a process of ‘testing’ possible alternate explanations for the observed outcomes, to identify the most logical and compelling causal explanation (Wynn and Williams 2008).

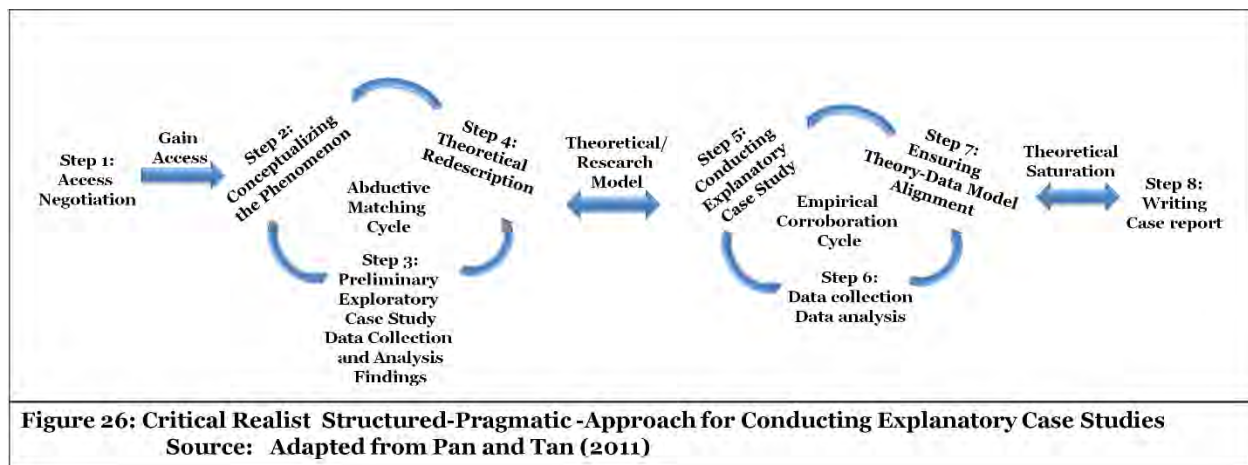
Researchers may empirically corroborate the proposed causal mechanisms with data gleaned from multiple comparative cases or events within a given or similar context, by use of multiple case studies (Bergene 2007; Williams and Karahanna 2013). The

empirical corroboration from multiple comparative cases is to identify the related events or cases that have occurred, to see if the causal mechanisms proposed were activated.

Another empirical corroboration approach (the thesis's focus) occurs with single explanatory case-study (Easton 2000, 2010b; Wynn and Williams 2012). Researchers using this approach evaluate the explanatory potential of the hypothesized causal mechanisms, based on how social actors' perspectives, experiences, and actions in the phenomenon (i.e., emergent usage of adaptive IS for e-financial services) change over time (Easton 2010a; Wynn and Williams 2008). By doing this, mechanisms that are encapsulated in the research model can be confirmed or refined. The process is usually based on longitudinal data that is discursively gleaned from the informants within the problem situation (Pawson and Tilley 1977; Wynn and Williams 2008).

8.2 Critical Realist Explanatory Case-Study

An explanatory case-study using a critical realist perspective has the objective of eliciting patterns in the data that could assist in accomplishing empirical corroboration (Wynn and Williams 2008). A critical realist approach to explanatory case-study is adopted in this study, as shown in Figure 26. Such an approach allows the researcher to look beyond the surface to a deep level, in order to identify the underlying mechanisms that explain the phenomenon in the data (Wynn and Williams 2012). It consists of eight steps (refer to Figure 26), having an abductive matching cycle and an empirical corroboration cycle.



A walk-through of the eight steps reveals that an explanatory theory-building approach uses inductive, abductive, retroductive thinking, and deduction as the central forms of reasoning, moving from a description of the concrete to the abstract, and back to the concrete (Danermark et al. 2002).

The abductive matching cycle has been discussed in Chapters 3, 4, 5, 6 and 7 of this thesis, which ultimately leads to the development of the embryonic research model. Following the abductive matching cycle is the empirical corroboration cycle (the focus of this chapter) (Vega and Brown 2011; Wynn and Williams 2012). It begins with the collection of additional data in the same situation, with the aim of obtaining corroborating evidence that transforms the embryonic research model into a fully-fledged theory (Wynn and Williams 2012). The next section, therefore, ushers in Phase 2 of the research design that details the additional data collection process.

8.3 Phase 2 of the Research Design

Phase 2 data collection is important because Phase 1 was not designed to identify underlying mechanisms, but to ‘flag’ them for further pursuance (Eastwood et al. 2014). To refine and ground the developed research model in the data, a second phase of qualitative data is required. As pointed out by Pawson and Tilley (1977, p. 85), “*the choice of method has to be carefully tailored to the exact form of hypotheses developed earlier*”. Similar to Phase 1 of the research design, data collection took a longitudinal

approach, involving the same key participants in both the design and the use of the system, as shown in Figure 17 and in Table 12 of Chapter 5. Structured participant observation and realist interviews were used in this phase to serve as the basis for answering the research questions. Answering the research questions, however, was a matter of collecting additional data that incorporated non-discursive referents, such as motives of action in the technology. Thus, the extensive data collection effort resulted in sufficient data upon which to base answers to the research questions.

8.3.1 Participant Observation – Structured

Structured observation is powerful in eliciting underlying structures and mechanisms in the system's emergent use, in the light of the research model. It is important to reiterate that the research model is not used to force data, but is used as a sensitizing framework. It provides the enabling environment where fresh theoretical insights can still emerge and the model is open for revision (Layder 1998; Patton 1990). Since structures and mechanisms are embedded in the system and made clearer during design processes (Carlsson 2005), it was necessary to go back to the case organization to observe the activities of the managers, software designers, and the user-group in the case organization once again. This opened up the possibility of uncovering the mechanisms not thought of or unknown to be relevant *ex ante* to “*understand why and how an IS initiative works*” (Carlsson 2005, p. 99; Iivari et al. 2010). Besides, when mechanisms generate an event(s), it takes place in the actual domain and is experienced in the empirical domain, therefore participant observation assisted in getting an in-depth understanding of mechanisms' effects at the empirical domain (Bøllingtoft 2007; Mingers 2004c), by observing the user-group in the case organization.

By observing the managers, software designers, and user-group activities and their interaction in the case organization, the researcher then “*analyzed the outcomes [of such interactions] to discover if the conjectured mechanism/context theories are confirmed*” (Carlsson 2005, p. 99). Mechanisms are also contingently related to observable events specific to their environments (Steele 2005). Therefore, participant observation that is structured unveiled the possibility of observing the system's

functionalities within its natural context (Bøllingtoft 2007; livari et al. 2010). Such a natural context is embodied with socio-economic or cultural structures (Mutch 2002, 2005). The distinction between observation and interview got blurred at this phase. As pointed out by Bøllingtoft (2007, p. 424), “*in participant observation the researcher is much less likely to have ‘set-piece’ interviews*”. Thus, to properly assign form and precision to data, an opportunistic role was taken, involving discussing with the participants, and interjecting the discussion with informal interviews while still carrying out observations.

For instance, during the course of participant observation, the South African government enacted the POPI Act of 2013, as highlighted in Chapter 6. The POPI Act seeks to regulate the processing of personal information to ensure privacy compliance in online interactions. A sense of urgency was exhibited by software designers to script the modalities of the POPI Act into the functionalities of the system. An ad hoc team that included outsourced online security experts was constituted. Such a team was mandated to re-factor the system’s security module, to accommodate the business process workflow that would handle such specific legislation. When the researcher asked one of the designers in the ad hoc team what the rush was to refactor the system’s security workflow, she replied:

We could risk going to jail or pay a fine of up to 10 million rand if we did not comply with the POPI Act. Besides, considering the nature of our business, our users could start withdrawing from our system, citing security or privacy concerns because of our non-compliance. Many may also quit because of trust-related issues when they see that we did not implement such an important legislation in our software. So, we are giving some thought to the type of personal information we process and how our system processing complies with the eight conditions of the POPI Act, after we have scripted them into the system, enterprise-wide. (#SD1)

The observation of the designers and user-group interactions to enforce the POPI Act legislation into the system functionalities is an event that confirms the following causal mechanisms: embeddedness and under-design, dialectic flux of trust and distrust mechanism, and an experiential factor such as security or privacy concerns.

Similar events of this nature occurred in the case organization; the researcher observed and noted them in the form of reflective memos to capture the ones that are conditionally relevant (Layder 1998; Merriam 1988). The researcher's reflective memo is what Layder (1998, p. 58) calls "*theoretical memos*". They were created and updated on a weekly basis as a premise for further reflections. They guided the subsequent search for emergent themes until data saturation was reached. The reflective memos here are not as described by Strauss and Corbin (1990, 1998). Rather, they are the researcher's self-dialogue embedded within the dialogical relationship between the research model and the practical issues surrounding the data collection and analysis (Layder 1998, pp. 47-59).

8.3.2 Critical Realist Semi-structured Interview

To conduct the semi-structured interviews, a meeting with the same participants as shown in Table 12 in Chapter 5 were rescheduled, and they happily obliged. The semi-structured interviews were influenced by the realist analytical procedures advocated by Pawson and Tilley (1977), an approach Smith and Elger (2014, p. 116) classified as "*realist theory of data collection*". Smith and Elger (2014) argue that parts or the whole of a phenomenon can be adapted, for realist theory of data collection in social research to easily extract the underlying logic behind participants' discourse. The interview is embedded with measures to ensure that the researcher is not simply '*toeing the party line*' of informants but, rather, latent meanings behind informants' verbalizations are made obvious through dialogue and negotiation (Pawson and Tilley 1977; Smith and Elger 2014). Unlike in Phase 1, the interviewing process in this phase is strongly theory-driven, where "*the researcher's theory [i.e., the research model] is the subject matter of the interview, and the subject (social actor or participant) is there to confirm, to falsify and, above all, to refine that theory*" (Pawson and Tilley 1977, p. 155).

The realist theory of data collection involves two processes: (1) the teacher-learner function, and (2) the conceptual refinement process. The former is to ensure that the researcher takes the active role in educating the "*overall conceptual structure of the investigation to the subject [or participants]*" (Pawson and Tilley 1977, p. 168). By

sharing with the interviewees the researcher's own theory, the researcher engages the active role of the interviewees who not only hold facts and details of experience, but can offer them to the researcher via negotiation and dialogue. While the researcher holds the expertise of concepts, the interviewees too hold the expertise of experience, actions, and apperceptions. Therefore the theory-driven interview, framed in the form of communicative interaction, is used to extract statements that point to the expected causal mechanisms/experiential factors on the basis of "*I'll show you my theory if you'll show me yours*" (Pawson and Tilley 1977, p. 169).

The conceptual refinement process of the realist theory of data collection mandates that the "*respondents deliver their thoughts on their own thinking in the context of, and (perhaps) as a correction to, the researcher's own theory*" (Pawson and Tilley 1977, p. 168). Data were harvested with a high degree of reflection and iteration. Such an approach of harvesting data mimics what Schön (1990) describes as a 'move-testing' experiment, in which theory, developed through reflection, can be confirmed or negated in the course of action. Besides, mechanisms are not perceptible and cannot be identified by the abilities of humans to perceive them; rather by their effects, interactions, and ability to do things (Wynn and Williams 2012).

Getting started: The research model in Figure 24 was presented to each of the participants. It was reasonable to begin with an overview of the diagram to reach a consensus with the participants. By this, the researcher and the participants were on the same page as to how to walk through the diagram in a stepwise manner. The researcher asked general questions such as: *Does the researcher's theory fit with what you think is happening in the phenomenon? Do you agree or disagree with it, and if agreed why? And if not, why not?* Being the teaching stage (often in more or less subtle ways), it recognizes the theory-testing purpose of the research. Through these questions, participants are understood to respond to what they deem correct and relevant, which speaks in relevant ways to the case at hand. They, having learnt that the theory is under verification, are able to teach the researcher about those components of the phenomenon in question in a particularly informed way. This

process establishes the ‘teacher-learner relationship’ or ‘assisted sense-making’ that helps in exhuming the underlying causal mechanisms (Pawson and Tilley 1977).

Asking prepared specific questions: With every step, the researcher focused on each structure/mechanism/factor at this point, and applied the prepared questions such as: *Which structure/mechanism/factor do you suggest as producing the emergent usage in this application or reflecting its characteristics?* , *How can this structure/mechanism/factor be supported in this context?* The participants were encouraged to respond to these questions and contribute their varying, and potentially conflicting, viewpoints and comments. For each statement, the researcher used explanatory cues from the interviewees to enable them to clarify their thinking. Such explanatory cues included: *What do you mean by that? For whom/in what circumstances would that work?*, *Are you saying that . . .?*, and *‘Do you say that because. . .? How?* Such explanatory prompts enabled a “*real condition for mutual understanding to emerge*” (Pawson and Tilley 1977, p. 168).

Collecting contributions: By using a digital tape recorder and field notes, the researcher collected the answers, hints, and comments, while asking for any references to further documents that could support the participants’ viewpoints.

Focusing on the researcher’s own theory/model: The research model is considered as both the researcher’s theory and the data-collecting artifact or, in the words of Star and Griesemer (1989, p. 393), a “*boundary object*”. A boundary object is defined as an “*object(s) which is both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites*” (Star and Griesemer 1989, p. 393). Despite being subject to varying interpretation across different participants, a boundary object has enough immutable content to maintain integrity, while being used to express ideation and communication in face-to-face interviews (Star and Griesemer 1989; Zhu et al. 2010b). Thus, utilizing the research model as a boundary object allowed participants who are experts in that very context of investigation to interact with, react to, negotiate around, and refine the theory (Pawson and Tilley 1977; Zhu et al.

2010b). The process of refining the researcher's model is similar to where architects use physical models or sketch drawings as boundary objects, to express and reason out a better model among clients, and civil and structural engineers. Therefore, by the use of theoretical memos (Layder 1998), the researcher integrated the varying perspectives of the participants. It was ensured that the collected contributions were inserted and traced to the boundary object, leading to growth or elimination of structures /mechanisms /factors, and aligning them to the ongoing discourse. Doing this did not necessarily imply that every proposal from the participants shaped the final outcome of the research model, but rather that there was a chance to do so.

Dealing with conflicts: Here the researcher adopted theoretical memos, triangulation of data during analysis, and respondent's validation of the theory, that seemed to explain the emergent usage of their software application. Uncovering conflicts among varied informants suggested to the researcher that respondents were not toeing '*party lines*', but were giving a true account as the basis on which the structures/mechanisms/factors were supported in this context. There was room for the participants to challenge the embryonic research model, providing clarifying viewpoints on issues that assisted in the refining of the model. The *realist theory of data collection*, unlike the conventional interviews, alerts researchers to the importance of participants in developing a theory, by treating them as fallible experts whose understanding needs to be formalized and tested against the theory. It has its shortcomings, as there are no tick-box recipes for conducting such interviews. It requires sustained thinking and imagination to work through the theory, figure out exactly what data patterns to look for, and where to find them to test or arbitrate between theories (Pawson and Tilley 1977).

8.4 Summary of Data Collection for the Explanatory Case-Study

The two data collection techniques (participant observation and interviews) in this Phase 2 also offered complementary perspectives with that of the data collected in Phase 1, and data from both phases were used for answering the research questions. In addition to the data from Phase 1, each technique used in Phase 2 collected different

types of data, each of which had special utility for the research. Table 15 summarizes the sources of data as it pertains to Phase 2 and the utility of each type of data meant to answer the research questions.

Table 15: Type and Utility of Data from Each Data Collection Activity in Phase 2			
Data Source	Type of Data	Utility of Data	Purpose
Participant Observation (Structured)	• Textual data in the form of: researcher's field notes, observations and experience of managers, designers, and user-group in the case organization. • Events, activities, and process occurring in the case organization associated with emergent usage of the technology. • Textual data sensitized by the research model.	• Provided researcher with experience of IS development and emergent usage in the natural context of the people and activities involved.	• Assisted in collecting descriptive details about the continuous system development to support user requirement changes while-in-use. • Assisted in interpreting and understanding the data collected in the realist interviews. • Used for answering RQ1 and RQ2 of the thesis.
Realist interview	• Textual data in the form of: participants' experiences, apperceptions, and actions in the technology. Participant's interpretation and reinterpretation of the technology-in-use. • Contextual information that elicited enabling casual conditions. • Textual data sensitized by the research model.	• Provided in participants' own words, their interpretation and understanding of mechanisms/factors that explain the case understudy. • Corroborated data with other sources.	• Assisted in discovering, activities, entities, processes, forces, the contexts that shape the system's development, and use. • Assisted in discovering the non-discursive realities that unveiled the underlying causal mechanisms. • Used for answering RQ1 and RQ2 of the thesis.

Similar to the Phase 1 data collection approach, the multi-method approach of data collection provided a basis for triangulation between data sources (Pawson and Tilley 1977). Altogether, the data gleaned from these multiple sources should not be seen as direct descriptions of structures/mechanisms (Archer 1998a). Rather, the data were used as a resource to know about them, and their real causal powers. This is, because agential actions in the technology are related to, conditioned by, and influenced by the structural mechanisms the system possesses within its ecosystem (Lawson 2008; Mutch 2010b). Knowing about these is obvious via the actors' experiences, especially in cases like that under study (Danermark et al. 2002), "*where [such] mechanisms under investigation exist in its purer [or obvious] form*" (Meyer and Lunney 2013, p. 3).

8.5 Data Management and Preparation for Analysis

The data collection activities resulted in a wealth of qualitative data in text format from both Phase 1 and Phase 2 of the research design. Thus, management and analysis of data were the two primary challenges the researcher initially faced. Similar to Phase 1, Nvivo was used to create databases to store and manage the various data collected, including the researcher's reflective memos and field notes.

The next section discusses the data analysis.

8.6 Data Analysis for the Explanatory Case-Study

The data analysis was underpinned by critical realist assumptions, an approach that affirms the existence of 'reality' but, at the same time, recognizes that its representations are characterized by experiential factors that capture the experiences of social actors, mediated by structures and mechanisms that cause them (Archer 1995; Iosifides 2011; Opperman et al. 2013). Thus, participants' sense-making and experiences as verbal manifestations were first taken at face value. They are interpreted as depicting the reality as fallible truth without rendering them independent of the mechanisms that caused the reality to become, including the socio-economic context in which they occurred (Maxwell 2012; Opperman et al. 2013). Therefore, the data analysis was of two types, one in the form of a case description and analysis (see Chapters 5 and 6) that captured the context, as reported in Phase 1 of the research design. The second phase took the shape of a semantic and latent-based thematic analysis that incorporated data both from Phase 1 and 2 of the research design, to elicit the experiential factors, structures, and mechanisms.

Data analysis is "*the heart of theory-building process*" when using case-study approach (Eisenhardt 1989, p. 539). However, there are no systematic guidelines for qualitative data analysis that fit the principles of critical realism, considering the fact that methods are much less developed in this novel area (Vega and Brown 2011). This poses a

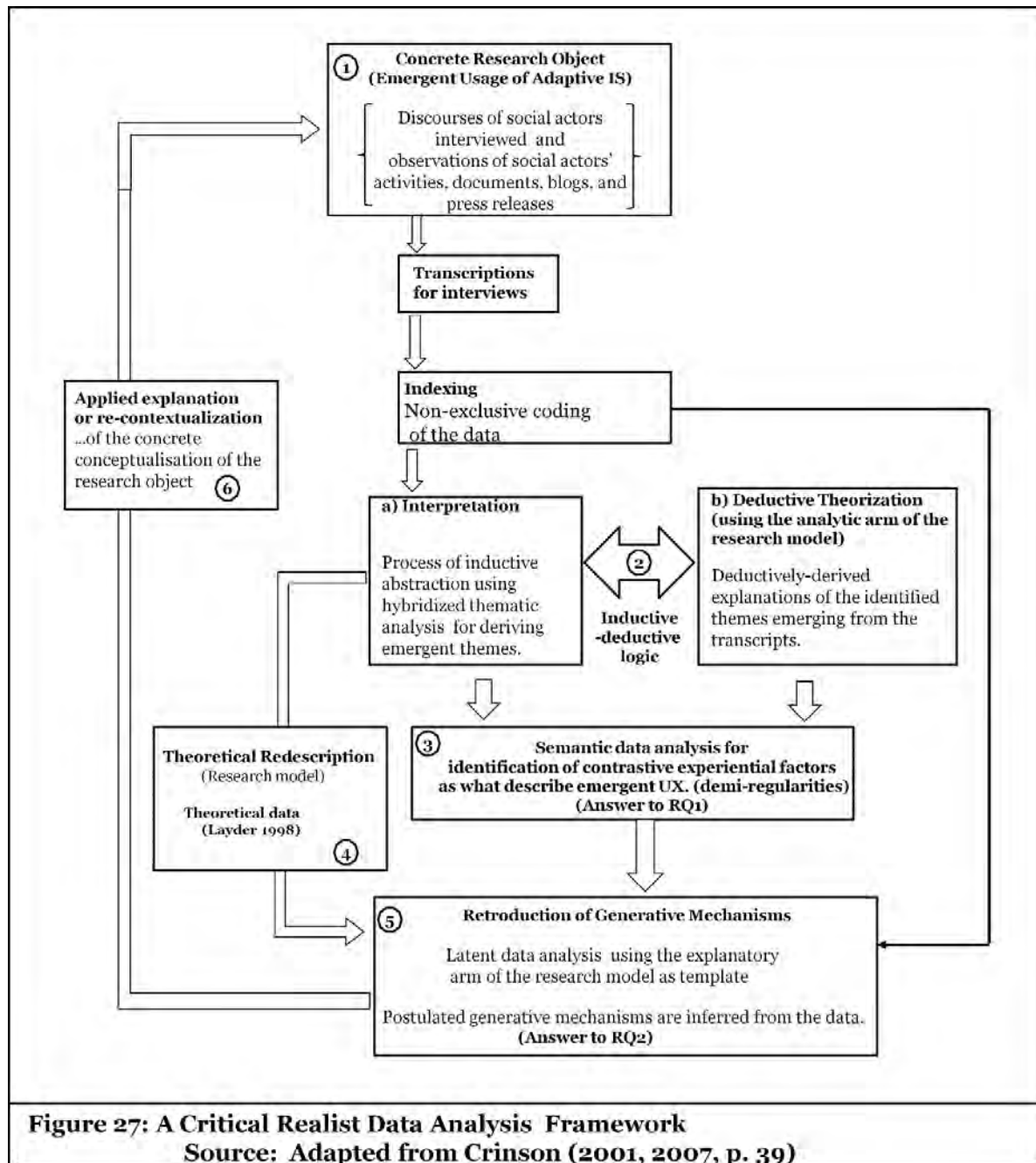
tremendous challenge in IS or social science research, wherein critical realism has been dubbed “*as a philosophy in search of a method*” (Yeung 1997, p. 55).

To identify underlying mechanisms from descriptions of a social phenomenon demands identification of patterns in data, hidden in participants’ discourse, that are mostly qualitative in nature. Also, to identify the data patterns that corroborate with the hypothesized mechanisms involves: (1) collating data from multiple sources, including transcribing the interviews and observation field notes, (2) immersing oneself in the data to gain detailed insights into the phenomenon being explored, (3) developing a data coding scheme, and (4) linking codes or units of data to overarching themes/categories, which may lead to the development of mechanism-based theory (Morse and Richards 2002).

In order to accomplish this sort of data analysis in this case-study, some realist IS scholars have suggested grounded theory data analysis method, especially when leveraging “*a continuous interplay between data collection and analysis*” (Oliver 2012; Urquhart et al. 2010, p.357). However, this thesis does not follow a grounded theory data analysis method. This is because of the strong theoretical considerations and theory-ladenness of the empirical processes used in collecting data, and the development of the researcher’s theory, as suggested by critical realists (e.g., Bygstad and Munkvold 2011b; Dobson et al. 2013; Layder 1998; Pawson and Tilley 1977). Besides, data collection and analysis processes did not run concurrently in this thesis as happens with grounded theory methods which allows further data collection to be grounded on what has been previously analyzed (Strauss and Corbin 1990). Such a concurrent run was not deemed suitable for this thesis, where data were collected at different stages and different times, to allow spurious mechanisms to wane and be made evident in the data pattern collected at separate phases (Crinson 2007; Miles and Huberman 1994).

Applying retroductive reasoning to data analysis, as is necessary in critical realist studies, involves induction, deduction, and abduction, in order to identify causal mechanisms (Crinson 2001, 2007). The retroductive data analysis is challenging

because it is not structured and formulaic and, as such, demands researchers' creativity and intuitiveness (Williams and Karahanna 2013). Danermark et al. (2002) offer some guidance by proposing a model (e.g., Bygstad and Munkvold 2011b; Dobson et al. 2013). However, such a model is more at the 'abstract level' when it comes to specifying an established qualitative data analysis framework. In order to demonstrate rigor, associated with openness, relevance to practice, and congruence with a methodological approach, while maintaining creativity and intuitiveness, Crinson's (2007) data analysis framework was adopted. This framework attempts to embrace the "*methodological philosophical principles of critical realism . . . [to] represent a very different approach to the process of qualitative data analysis*" (Crinson 2007, p. 37), as shown in Figure 27.



The data analysis framework incorporates Danermark et al.'s (2002) model and Lawson's (1997) concept of demi-regularities; it advocates the orthodox hermeneutic approach, without mentioning any specific type. By not forcing the hermeneutic approach to a specific type is deliberate in order to encourage theoretical flexibility. Such flexibility depends on the aim of the research and the process of retrodution that *"draw(s) heavily on the investigators perspective, beliefs and experience"* (Crinson

2001, p. 10; Sobh and Perry 2006). Thus, a hybrid approach was adopted that stems from the integration of Braun and Clarke's (2006, 2013) thematic analysis and an a priori template of codes approach outlined by Crabtree and Miller (1999), as well as Boyatzis (1998). Such a template was used to code the data and was developed a priori, based on the research questions and the research model (Sobh and Perry 2006).

The danger in this kind of approach is that the research model might not reflect all the generative mechanisms and its contextual conditions, as well as their outcomes found in the data patterns, which in essence will be missed during the data-coding process. However, the abductive manner of developing the research model via empirical evidence in the first phase of the research, from where a theoretical cut was taken via different thought trials, must have included plausible mechanisms in the model (Aaltonen and Tempini 2014; Sobh and Perry 2006). Besides, the open nature of the interview questions and the unstructured participant observations in the first phase of the research ensured that relevant mechanisms/factors and their outcomes were incorporated into the data corpus (Bøllingtoft 2007; Perry 1998).

More importantly, the realist theory of data collection (Smith and Elger 2014), used in Phase 2 of the research design, capitalized on serendipity while in the field, to accommodate unanticipated events or changes in the phenomenon as learning opportunities. This allowed the uncovering of any relevant mechanisms/experiential factors that might have been missed in developing the research model (Smith and Elger 2014; Sobh and Perry 2006). Although the researcher's own biases may be perceived as being subjective, critical realism, being value-aware, will minimize such biases (Wynn and Williams 2012). The minimization of such biases are possible, especially when backed up with feedback from participants who are experts in their own theories of activities and experiences, which they 'loan' to the researcher in their verbalized discourse (Bygstad and Munkvold 2011a; Pawson and Tilley 1977).

The adoption of Braun and Clarke's (2006, 2013) thematic analysis is because it is better positioned to address the aims of the research with its theoretical freedom. It has the capability of being used to analyze detailed and nuanced accounts of data, to uncover

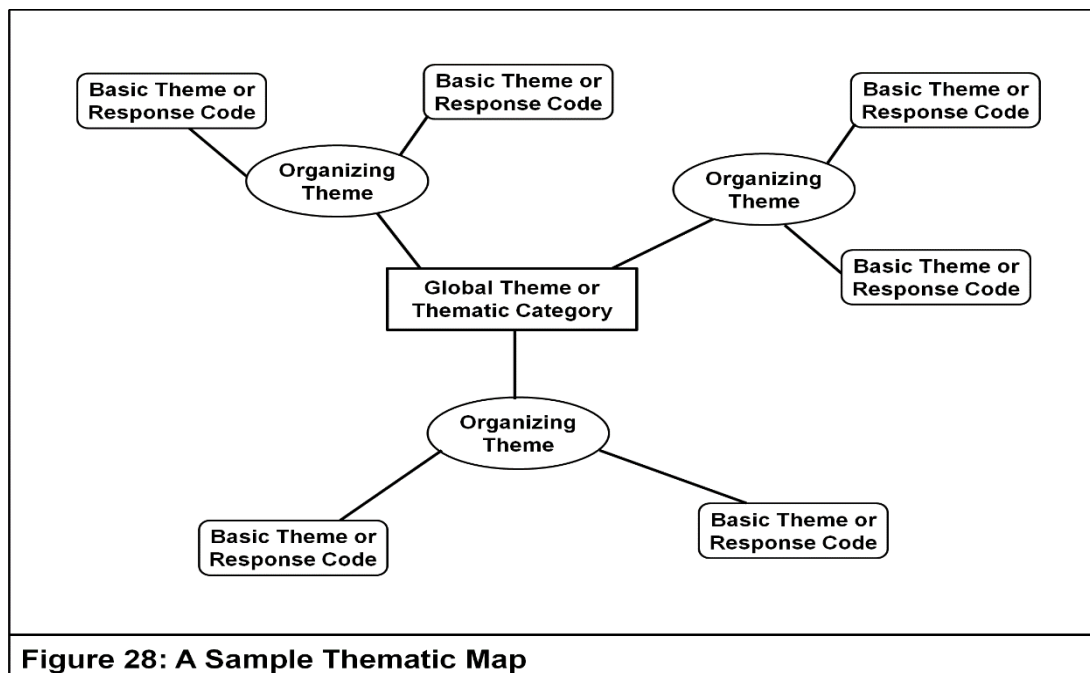
the underlying mechanisms and its outcomes. It also has established guidelines for performing the data analysis that is congruent with critical realist epistemology, “*for data are not coded in an epistemological vacuum*” (Braun and Clarke 2006, p. 84). In their words Braun and Clarke maintain that thematic analysis sits:

between the two poles of essentialism and constructionism, and characterized by theories such as critical realism... which acknowledge the ways individuals make meaning of their experience, and, in turn, the ways the broader social context impinges on those meanings, while retaining focus on the material and other limits of ‘reality’. Therefore, thematic analysis can be a method that works both to reflect reality and to unpick or unravel the surface of reality (Braun and Clarke 2006, p. 81).

Thus, the study first engaged the constructionist arm of Braun and Clarke (2006, 2013) that is characterized by semantic data analysis in stages 1-2 of the data analysis framework in Figure 27. Here, the inductive-deductive logic is effected with analysis that is focused on what the data say; this data deal with the content aspect and describe the visible, obvious components. Such data analysis is referred to as the manifest contents that are laden with participants’ interpretation (Braun and Clarke 2006). With semantic coding technique (Braun and Clarke 2006), a theme is found when one “*can answer the [probing] question: what is this expression [in the text or data] an example of?*” (Ryan and Bernard 2003, p. 87). A theme here is referred to “*as a meaning unit, that is, the constellation of words, sentences or paragraphs containing aspects related to each other through their content and context*” (Graneheim and Lundman 2004, p.106).

Three types of themes exist, namely basic themes or response codes, organizing themes, and global themes or thematic categories (Attride-Stirling 2001; Braun and Clarke 2013). Basic themes are the first order (i.e., lowest level) themes derived from the initial codes (e.g., a label given to identify a feature of the data). Organizing themes are the second order (middle-order) themes that cluster the basic themes on the basis of similar functionalities and meanings. Global themes are the third-order (highest-order) themes that hold no data, but a number of organizing themes, used to structure the analysis

(Attride-Stirling 2001; Braun and Clarke 2013). Based on the three types of themes, a thematic network map as shown in Figure 28 is developed to establish the relationship between the different kinds of themes. The thematic network map was used to illustrate some of the themes/constructs in this thesis, as depicted in Appendix E. Rectangles represent global themes, organizing themes took the shape of ovals and rounded-rectangles represented the basic themes.



Not all themes in this thesis followed the Figure 28 hierarchical structure; in some cases there were one-layer themes that “*capture[s] something important about the data in relation to the research questions, and represent[s] some level of patterned response or meaning within the data set*” (Braun and Clarke 2006, p. 82).

Being the first phase (i.e., stages 1 and 2) in the retrodution process in Figure 27 above, the coding of data must be a non-exclusive content indexing, to include all the participants' discourse or the entire dataset arranged in paragraphs. The content was inductively abstracted into ‘themes’ or categories that essentially represent the perspective of participants through interpretation. Such a categorization was further enhanced by using the coding template that captured the analytical arm of the research

model (Boyatzis 1998; Crabtree and Miller 1999). From here, the researcher mapped the coding process into a theoretical template, with the intent of identifying meaningful units (i.e., deductive coding). The theoretically derived categories here are contrastive (Crinson 2007; Patton 1987), and remained modifiable to the empirical material. They were considered as factors (i.e. UX) or demi-regs (Crinson 2007; Gläser and Laudel 2013; Lawson 1997) to reflect the actual domain as an answer to the research question RQ1. The outlet of this semantic data analysis captured the experiential factors.

However, the actualist analysis here cannot identify the underlying mechanisms and the stratified nature of the participants' discursive manifestations (Crinson 2001, 2007). It only describes and analytically resolves the concrete object (adaptive IS) under study into its key components as factors, which will be pursued further during the analysis to identify what must exist for such factors to be observed as the actualization of the underlying mechanisms (Crinson 2001, 2007; Danermark et al. 2002).

The *essentialism arm* of Braun and Clarke (2006, 2013) was engaged with next, characterized by retroductive latent data analysis, as in stage 5 of the data analysis framework in Figure 27. Here, the retroductive reasoning was effected with analysis that was focused on the interpretation of the underlying meaning of the text, referred to as latent content (Braun and Clarke 2006). To a critical realist using latent coding techniques (Braun and Clarke 2006), a theme is found when one can answer the probing question: *What must have been the case for such an expression to have been made in the text and why?* (Braun and Clarke 2006; Easton 2010a). It stems from the “content that could be inferred by . . . [the researcher] from statements manifest in texts” (Kleinnijenhuis et al. 1997, p. 206).

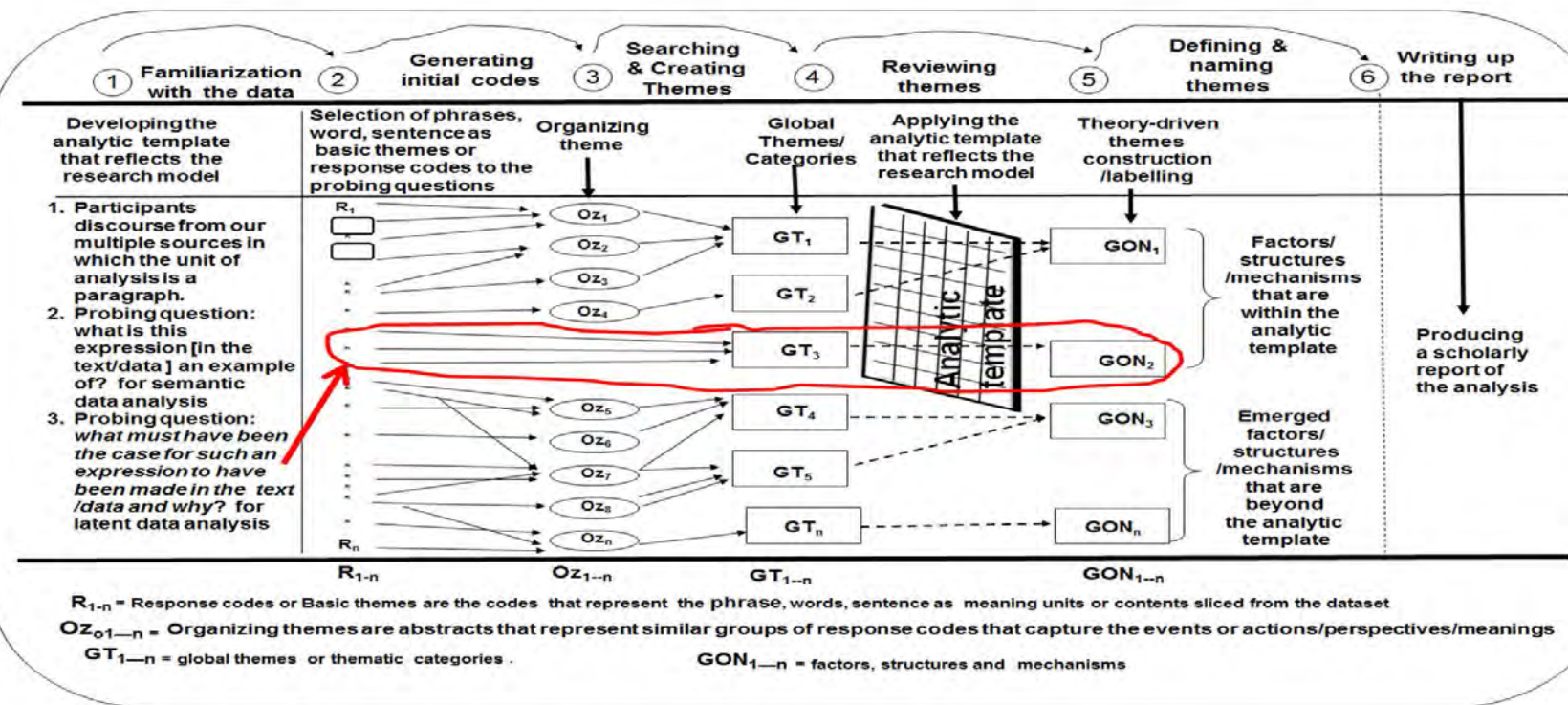
Thus, the researcher searched for a possible underlying logic in what participants said, using common sense to infer explanations, thoughtfully comparing findings with those in other studies, and relating findings to the explanatory arm of the research model (Ritchie et al. 2003). This search was strengthened by iterating first between the meaning of a single paragraph or statement, their surrounding statements, and the data as a whole and, secondly, by iterating between the interdependencies of these meanings

in the light of the research model. Because latent coding identifies *underlying* ideas and patterns that are heavily influenced by theoretical assumptions, global themes can easily be inferred directly from the paragraph or phrase that holds the unit of analysis (i.e., one layer theme) (Olsson and Väänänen-Vainio-Mattila 2011).

Prior to the latent coding in stage 5 in Figure 27, theoretical redescription of the phenomenon took place as in stage 4 (Layder 1998), which also captured the research model. Thus, the explanatory arm provided the coding template to categorize the data into global themes similar to deductive theorization in stage 2 (Crinson 2007; Ritchie et al. 2003). However, the difference was that there was an engagement in counterfactual thinking beyond deductive theorization (Danermark et al. 2002; Gregor and Hovorka 2011; Meyer and Lunnay 2013). Counterfactual thinking is the process of using stored knowledge and experience in the phenomenon to explore the motives behind the data, by questioning: “*How would this be if not . . . ?*” “*Could one imagine what must have prompted the analytic themes in the data?*” (Danermark et al. 2002, p. 101). By doing this, the analysis moved from observable data to causal mechanisms in the light of the explanatory arm of the research model, to infer what must have been in existence, in order for the observed patterns in the data to be possible (Maxwell 2012; Wynn and Williams 2012).

8.7 Thematic Process

In the previous section, the critical realist data analysis framework was introduced. The thematic analysis took a multifaceted approach to scientific logic, employing inductive, deductive, abductive, and retroductive elements. This hybrid version of the qualitative thematic analysis is compatible with Braun and Clarke’s (2006, 2013) guiding principles, interspersed with the template analytic technique of Crabtree and Miller (1999), as well as Boyatzis (1998), as shown in Figure 29. It also incorporates the latent coding process of deriving global themes directly from the underlying meaning inferred from a text or paragraphs, by reason of the dialectic reasoning between data and theory, as specified by Layder (1998).



Induction –deduction –abduction –Retroduction

reflexive, iterative & dialectical reasoning between theory and data
 “an open mind is not an empty head” (Bong 2002, p. 5, in citing Dey 1993, p. 229)

Figure 29: Hybrid Thematic Analysis Process

Source: Adapted from (Boyatzis 1998; Braun and Clarke 2006; Crabtree and Miller 1999; Ritchie et al. 2003)

The various stages in the hybrid qualitative thematic analysis in Figure 29 will be discussed next.

8.7.1 Stage 1: Familiarizing with Data

The researcher became familiar with data by reflecting on the entire data collection process, verbatim transcription of the audio recordings of interviews, field notes, and the creation of theoretical memos (Braun and Clarke 2006; Dey 1993; Layder 1998). All the audio recordings were listened to and compared to the transcribed version for accuracy. Transcription as the first step in transforming raw data into useable information was carried out; the transcribed information was then validated by the participants. Familiarity with data was enhanced by manually coding 98% of the data, assisted by Microsoft Word. Nvivo QDAS was less useful (2% of data analyzed, was used mainly for virtual filing).

Creating categories/themes is both an empirical and conceptual challenge, as categories must be conceptually and empirically grounded (Dey 1993; Ritchie et al. 2003). Successful thematic analysis in critical realist research emphasizes creativity, thorough understanding of the content and context of the text, and inferring connections and relationship across contrastive categories, to capture the object of study (Ritchie et al. 2003; Sobh and Perry 2006). Therefore, sole dependency on Nvivo QDAS may lead to the decrease in sensitivity about these elements as experienced, which is also in line with the views of Sobh and Perry (2006).

Braun and Clarke (2006, 2013) discourage developing a theory-driven template before commencing an in-depth data analysis, but it was found to be helpful in this thesis and, therefore, the template was developed after preliminary scanning of the text, as advocated by Crabtree and Miller (1999) and Boyatzis (1998). To engage with a theory-driven template was crucial for this thesis because it focused the data analysis to answer the research questions. Such a template also served as a data management tool for organizing segments of similar text to assist in interpretation, as well as for providing a

clear trail of evidence for the credibility of the study (Boyatzis 1998; Crabtree and Miller 1999).

The entire dataset was manually sliced or ‘compartmentalized’ into paragraphs as units of analysis that held the participants’ expressions of their actions, apperceptions, and experiences with the technology (Gläser and Laudel 2013). Such paragraphs were then linked to each distinct factor/structure/mechanism in the template that stemmed from the research model, using Microsoft Word (Gläser and Laudel 2013). Thus, each factor, structure, or mechanism held the data content that tended to explain or infer its behavior (Boyatzis 1998; Crabtree and Miller 1999). Each paragraph was then marked with a unique identifier, to enable the identification of the source of information from the pool of the dataset.

After the compartmentalization, which filtered out irrelevant data from the deluge of data (which on its own was laborious and time-consuming), the researcher engaged a graduate student research assistant as an independent co-coder. We first familiarized ourselves with the theoretical template and the dataset, to check that the comments assigned to categories reflected the designated concepts. We also established a common understanding of the core concepts related to the research aim and agreed to resolve our disagreements via discussion. The compartmentalized data that were in Microsoft Word were imported to Nvivo (QSR 10) database for storage and to maintain the audit trail (Guba 1981).

8.7.2 Stage 2: Generating Initial Codes

The initial coding took the shape of open coding, similar to the grounded theory technique (Allan 2003). Probing questions, either for semantic or latent coding, as highlighted earlier or as seen in Figure 29, were posed to the datasets that had been compartmentalized. Thus, in a bid to answer the probing questions, the researcher thoroughly read the text line-by-line and ‘sliced-out’ the quote(s) that constituted the answer to the posed question(s), shown as underlined words, for semantic or latent coding. These became the verbal responses which the researcher placed as response

codes (**R_{i-n}**) or basic themes, as shown in Figure 29 (Attride-Stirling 2001; Braun and Clarke 2006). Thus, elicited response codes were ‘units of meaning’ in both content and context of the textual data classified as participants’ construction of meanings in the case of inductive coding (Gläser and Laudel 2013). Such an inductive coding was extended to theory-driven coding for the analytic stage of the process (Braun and Clarke 2006; Gläser and Laudel 2013). Response codes of the same functional meaning were clustered as organizing themes (**O_{z1-n}**) in the open-coding technique. The organizing themes that emerged became the guide for new lines of inquiry for subsequent analysis. Immersion in the data, with a reflection on the research model, provided a memo that explained what was happening in the data as the context for selecting themes from the datasets (Layder 1998). Importantly, writing theoretical memos commenced in parallel with the coding. In doing this, ideas about codes and their relationships, as they struck the researcher, were noted, until the end of the data analysis (Braun and Clarke 2006).

8.7.3 Stage 3: Searching for Themes

To search for themes, several organizing themes were grouped. Those with functionally equivalent meanings were grouped into a thematic category or global theme (Attride-Stirling 2001; Boyatzis 1998; Braun and Clarke 2006). The functional equivalent of the organizing theme was further strengthened by the internal homogeneity of theme and the data that captured the functionalism of the organizing theme (Patton 1990). Following Olsson and Väänänen-Vainio-Mattila (2011) and Ritchie et al. (2003) in retroductive latent data coding, or what Ritchie and colleagues called explanatory coding, the basic and organizing themes were bypassed. The global themes, as shown in Figure 29 that held the underlying meanings, as inferred from the paragraphs, were identified first. After this, the basic theme and the organizing themes were coded – which was not necessary in some cases – and linked to the global theme or thematic category.

The researcher’s tenacious hold of each thematic category as ‘real’ was consolidated as they emerged, by rigorously searching for ‘disconfirming instances’ in the whole data and, if no contradictory evidence was found, the theme was then pursued until

saturation (Bazeley 2009; Mason 2010; Morse 1995). Thus, a theme was not just “*discovered in the data*”, or laden with the notion that “*data speak for themselves*” (Layder 1998; Meyer and Lunney 2013, p. 6). Rather, it was created as one conceptual outcome, by the researcher’s dialectical reasoning between the data and the research model (Dey 2007; Layder 1998). Room was made for potential themes to emerge, without reference to the coding template (Braun and Clarke 2006). Thus, the themes identified were as a result of “*both inductive (data-driven) and deductive (theory-driven) reasoning*”, in order to identify the factors for semantic analysis (Iivari 2008, n.p), while the analysis was furthered through an abduction-retroduction process to identify the structures and mechanisms, as inferred from the data (Crinson 2007; Easton 2010a).

8.7.4 Stage 4: Reviewing Themes

The process of revision began by thinking about the themes in more detail to see how they captured answers to the research questions.

8.7.5 Stage 5: Defining and Naming Themes

At this stage the coding/analytic template was fully applied by using it to label the thematic categories or global themes. Such categories represent “*the essence of what each theme is about . . . and [to] determine what aspect of the data each theme captures*” (Braun and Clarke 2006, p. 92). The coding template provided the theoretical structure within which to develop the global theme, in answer to the research questions. However, the researcher still retained open-mindedness and flexibility to accommodate different emphases in the data. The labelling of additional themes outside the coding template was based on the “*meaning they evoke*” or “*words of respondents*” or by bringing in further theory (Bazeley 2009; Strauss and Corbin 1990). Re-visitation to literature/extant theories, even outside the initial choice theory of CAS, later brought in meta-design theory was done. Thus, selected theories were seen to offer the best explanatory power. It also make more sense of the themes labelled and their functional interdependence (Layder 1998; Sayer 2000).

By jointly creating the thematic categories with a co-coder at different times and after many meetings to assess reconciliation, we established a total match percentage of over 85%, that is, $\text{total match \%} = (\text{number of matches}) \div (\text{number of matches} + \text{number of mismatches})$, to ensure an adequate inter-coder reliability, as suggested by Williams and Karahanna (2013) in critical realist IS research. Joint creation of themes is also favored by Braun and Clarke (2013, p. 285), when data analysis takes a critical “*realist framework*”, which we also found useful in this thesis, since all observations are fallible (Bhaskar 2008b). The creation of themes is heuristic and depends on the relative degree of skill and subjectivity of the coder. This was obvious in latent coding that sought for underlying meanings, where problems of reliability and specificity were a concern (Babbie 2010). Thus, by involving two independent coders with similar knowledge about the content being coded, optimal themes that reflected the event and which were commonly agreed on by the two independent coders were identified, having reached theoretical saturation (Williams and Karahanna 2013).

At this point a clear definition of each global theme that reflected the scope and content of the organizing themes was evident (Braun and Clarke 2006; Williams and Karahanna 2013). Also, at this point, the global themes were assumed to be empirically validated as the structures/mechanisms/factors (Wong 2012).

8.7.6 Stage 6: Producing the Report

At this stage, the analytic narrative and data extracts were woven together to offer a mechanism-based explanation of the concrete object under study, as discussed in the subsequent Chapters 9 and 10 of this thesis.

8.8 Quality and Rigor of the Research

Taking on a critical realist perspective has a significant influence on the criteria used for validating or assessing the quality of the research findings. Critical realist research focuses on *epistemic* criteria that capture the practical adequacy for assessing the validity of findings (Dunn 2012; Iosifides 2011). This is because evaluation criteria for

demonstrating quality apply only within the same tradition and might not be employed for other research traditions (Healy and Perry 2000; Marton 2013). For instance, Benbasat et al. (1987) recommend evaluation criteria exclusively meant for positivistic case-study IS research. Klein and Myers (1999) craft a set of seven principles for interpretive field studies on the basis of hermeneutics assumptions. In a similar fashion, Healy and Perry (2000) formulate six epistemic quality criteria for judging a critical realist case-study, as shown in Table 16, although they argue for its relevance in diverse methods used in intensive research design. They maintain that “*the quality of scientific research done within a paradigm has to be judged by its own paradigm’s terms*” (Healy and Perry 2000, pp. 120-121).

Table 16: Critical Realism Case-Study Quality Criteria**Source: Adapted from Healy and Perry (2000)**

Level	Criteria	Brief Description of Criteria for this Realism Research	Case Study Techniques within Realism paradigm
Ontology	Ontological appropriateness	Research should focus on 'world three'. Following Popper in Magee (1985), Healy and Perry caption such a world as <i>"abstract world that are born of people's minds, but exist independently of any one person"</i> (Healy and Perry 2000, p. 120). Such a world also demands a transcendental question. Therefore, research should focus on inter-subjectivity of creation that neither belongs to the objective world ('Popper world one') nor to the subjective world ('Popper world two').	Selection of research phenomenon of 'How' and 'Why' issues. 'Why' type of research question (what must be in existence for event X to be possible?)
	Contingent validity	The phenomenon under study is considered to be open with a fuzzy boundary. Thus, causal mechanisms responsible for that phenomenon are not fixed, but contingent on their environment. Therefore, focus is on the context in order to provide insights into the generative mechanisms of why things happen. Social actors under investigation are prone to hold different perceptions of the 'real' and, therefore, we develop a research design that captures these variations of perceptions. Contingent validity is <i>"about generative mechanisms and the contexts that make them contingent"</i> (Healy and Perry 2000, p. 123), and it anchors on providing answers to research questions that are context dependent.	In-depth questions, emphasis on 'Why' issues/questions, and description of the context of the cases
Epistemology	Multiple perceptions of participants and of peer researchers	Since research is value-aware, the researcher has to rely on multiple perceptions. This could be contradictory of a single, knowable reality which concludes in triangulation of data sources.	Multiple interviews, supporting evidence, and triangulation Published reports for peer review
Methodology	Methodological trustworthiness	This <i>"refers to the extent to which the research can be audited [by a third party]... Thus, developing a case-study database and the use of quotations in the written report"</i> strengthen the trustworthiness of the research (Healy and Perry 2000, p. 123).	Case study database Intersperse the case-study report with relevant quotations and clearly state the procedures such as case selection and interviews.
	Analytic generalization	Analytic generalization, rather than statistical generalization. Since critical realism focuses on explanatory theory building, generation should be to analytical generalization (Tsang 2013).	Identify research issues before data collection, to formulate an interview protocol that will provide data for confirming or disconfirming theory.
	Construct validity	This is similar to Yin's (2003) 'construct validity' and it <i>"refers to how well information about the constructs in the theory being built are measured in the research"</i> (Healy and Perry 2000, p. 124).	Use of prior theory, case study database, and triangulation

Having been supported by the literature (e.g., Bøllingtoft 2007; Golafshani 2003; Iosifides 2011), Healy and Perry's (2000) six quality criteria were drawn on to provide insights into why this study was trustworthy and sound, starting with ontological appropriateness.

8.8.1 Ontological Appropriateness

The transcendent research question (i.e., *Why does emergent usage occur in adaptive information systems?*) of this thesis positioned the case-study research as being ontologically appropriate. Such a research question suggests that the phenomenon is within the Popperian world three (Magee 1985), where social reality exists independent of people's minds, with underlying mechanisms as causal powers (Volkoff and Strong 2013).

8.8.2 Contingent Validity

The study met this criterion by investigating adaptive IS for e-financial services that are open, where causal mechanisms that are responsible for its emergent usage are not fixed, but contingent upon the environment. The identification of the contextual conditions by which some mechanisms function, helped achieve the contingent validity of this research.

8.8.3 Multiple Perceptions of Participants and of Peer Researchers

The research adopted multiple methods and triangulation to achieve this criterion. This provided windows through which different pictures of reality were gleaned, to answer the research questions. Triangulation occurred with the data, theories, methodologies, and investigators (Denzin 1970). For data triangulation, multiple sources of data including participant observations, interviews, documents, blogs, photography, and press releases were used; these spanned across different times over a three-year period, to capture changes in social trends and discordant tones. By engaging with participants with discordant tones, the researcher accepted data that could challenge the formulated explanations. For example, by interviewing a bank officer who had a negative perception of the launched IS innovation under study, it was possible to examine both the discrepant and the supporting data and assess whether it was more plausible to modify or retain the study conclusions (Maxwell 2004).

Theory triangulation in this research involved use of a conceptual framework, extant theories of CAS and meta-design for theorization, data collection, analysis, and interpretation of the phenomenon. Layder (1998, p. 68) suggests that a multi-strategy of this nature, where theories and empirical data are incorporated, “*automatically contributes to triangulation*”. While the nature of this study precludes the use of more than one researcher, the use of an external data coder during data analysis, as recommended by critical realist IS researchers (e.g., Williams and Karahanna 2013), can be said to contribute to investigator triangulation to some extent.

8.8.4 Methodological Trustworthiness

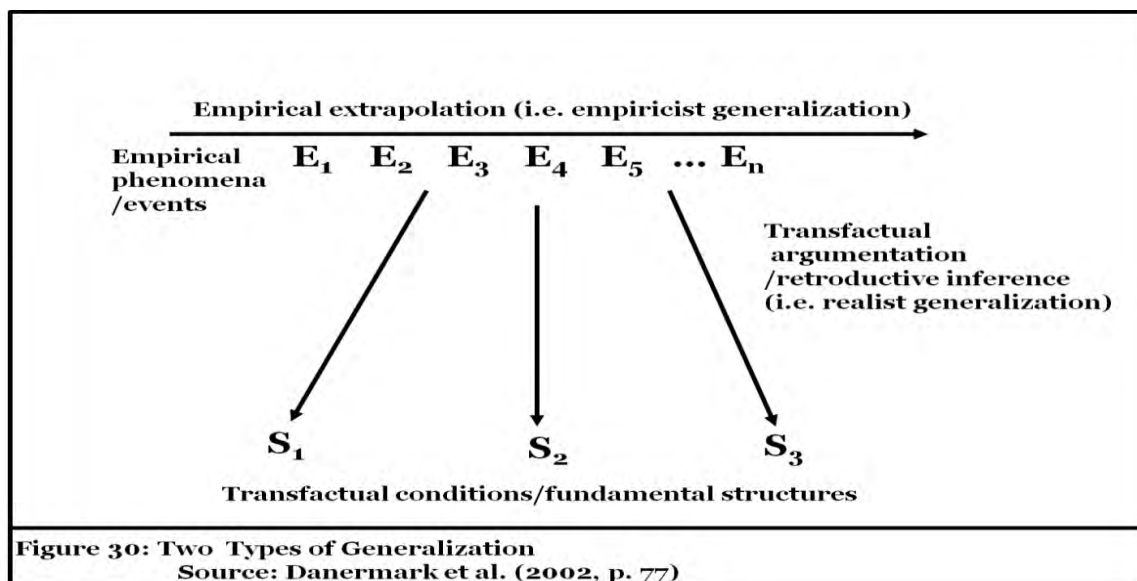
Possible techniques deployed to meet this criterion were suitable maintenance of a case-study database, a case-study protocol, respondent validation of data, and the use of participant quotes in the written report (Healy and Perry 2000; Maxwell 2012; Yin 2009). The case-study database illuminates the progress from data to research findings, thus establishing a chain of evidence. The database was maintained by using Nvivo (QSR10) to keep an adequate audit trail. The case protocol included a schedule that stipulated an overview of the project, field procedures such as access to the case organization, guidelines for data management, confidentiality upkeep, and the data coding requirements. The interview protocols also stipulate the main questions, as shown in Appendix C.

Respondent validation of the transcribed data and the final report verified the accuracy of the research (Bygstad and Munkvold 2011a; Maxwell 2012). By this, it was possible to rule out the potential for misrepresenting the participants' experiences, *apperceptions*, and views about the technology. Repeated observations and interviews, which were embedded in the prolonged period of data generation that lasted for three years at different time periods, strengthened the methodological trustworthiness of this research (Maxwell 2012). This resulted in getting a “*clearer picture of causal processes, as well as helping to rule out spurious associations and premature theories. They also allow a much greater opportunity to develop and . . . [confirm] causal hypotheses during the course of the research*” (Maxwell 2004, p. 255). Prolonged researcher involvement,

which was a strength of this research in many respects, however, was also a potential threat to the validity of the interpretations and explanations. Such a threat to validity is due to the researcher's positive attitude and motivation towards the workability of the technology and the research. However, the accommodation of both *discrepant and corroborated* evidence about the technology, with reflexivity, and the exercise of caution as being a value-aware researcher, reduced such biases to a minimal level (Healy and Perry 2000; Maxwell 2004).

8.8.5 Analytic Generalization

Two types of generalization exist as shown in Figure 30: empiricist generalization, and realist generalization (the thesis's focus) (Danermark et al. 2002). Realist generalization takes the form of analytic generalization. In critical realist case-study research, analytical generalization "*refers to generalizing from the findings of a case to theory or theories that seems to explain the case which "consists of postulated structures and mechanisms that operate in the real domain"*" (Tsang 2013, p. 7). To achieve such theory generalization, observed events were explained by the theory of structures and mechanisms developed around it, as shown in Figure 30, and particularized in this thesis in Chapter 10.



The theory-led analysis of data and the discovered single case domain to which the study's findings can be generalized, in terms of the postulated mechanisms, upheld the analytical generation criterion in this study. As put forth by Easton (2000), “. . . *one case is enough to generalize: not generalizing to any population, but to a real world that has [just] been discovered*” (p. 214).

8.8.6 Construct Validity

The case-study research achieved construct validity by the abductive pattern-matching approach used in developing the research model (Christie et al. 2000; Meyer 2001; Trochim 1989; Vega and Brown 2011). Triangulation of evidence that was grounded in data continually resonated with the concept of emergent IS usage (Meyer 2001). Other means by which construct validity was achieved included: (1) the use of prior theories (i.e., CAS and meta-design) in theoretically re-describing the phenomenon and using the concepts that make up the theories to abstract the causal mechanisms, which were corroborated by the empirical data (Danermark et al. 2002), (2) the upkeep of a case-study database to establish a chain of evidence that logically ensured the consistency and completeness of the theoretical constructs across multiple sources of data, and (3) having some key participants review the drafted case-study reports (Christie et al. 2000; Patton 1990).

8.9 Ethical Considerations

To strengthen the quality of research also required that the study address ethical considerations, since it is incumbent on the researcher to work towards being ethical in all aspects of the research process. Ethical considerations demand that the researcher makes values and assumptions in relation to all aspects of the research explicit for the reader's scrutiny.

To do this, the meta-theoretical assumptions, the extant theories, and the methodological principles which informed the research were made explicit. Furthermore, emergent IS usage was specified as the case under study through the

problematization of a somewhat ambiguous situation, since the researcher is a user of the digital innovation and, at the same time, researching his own practice. Lastly, the research processes were specified in as much detail as could warrant a third party to adjudicate its rigor and practicality when using a critical realist lens, and by providing as much contextual background for the case-study as possible.

Other ethical issues were addressed in relation to the research participants by maintaining their anonymity. Particularly, the University of Cape Town (UCT) ethics in research code was adhered to, by developing a consent form (see Appendix B), which the informants were required to read, understand, and endorse, prior to participating in the research process. By doing this, confidentiality and protection of shared sensitive information that had to do with personal or monetary information or other trade secrets in the case organization were assured.

The consent form also informed the participants of their rights and risks, if any, that were associated with the research process. Anonymity, which was introduced in the research process, varies from weak to a strong form (Wengraf 2001). Participants/informants in the weak form of anonymity are not recognizable by the general public, except for those who know them well, while for a strong version of anonymity, the informant would not recognize himself or herself in the published account (Wengraf 2001). In this research, the weak version of anonymity was adopted in that each of the participants was given a unique unidentifiable number, but their job roles were used in the case description. Since real names and job roles were defined on the case organization's website (i.e., 22seven.com), which is in the public domain, acquaintances who might be exposed to this thesis could easily trace the participants. The real name of the case organization and their website were used, as agreed to by the organization, while the real name of the banks for some information pertaining to them in this research was in the public domain. For other participants outside the case organization, especially the users in the public domain, the use of unidentifiable numbers and fictitious names worked well in protecting their real identity, as far as the participants would permit.

There were other personal ethical decisions and challenges that were faced when interacting with the participants, who were highly knowledgeable and were empowered economically in a democratized information environment. As Denzin (1989, p. 83) said, “. . . we must remember that our primary obligation is always to the people we study, not to our project or to a larger discipline”. These challenges stemmed from the fact that the adaptive e-financial system under study questioned the basic assumptions about anonymity and participants’ privacy in most traditional research protocols. For example, it was relatively hard to protect participants’ identities, when the participants themselves would not want to, simply because many of them happily blogged about their usage experience of the technology, using their real identity. The blogging was done in the user group webpage provided by the case organization in their website. In doing this, they explicitly expressed the type and numbers of accounts they had, and the name of the banks that held their money deposits. They also did this during their interview responses and wanted to keep them open during their feedback validation, even when the researcher highlighted the privacy consequences to them.

The researcher, always tried to keep from seeing respondents’ financial information during the interview processes, but they often revealed it openly as the interview was going on, with their smartphones and tablets. Users wanted to demonstrate the challenges they encountered when interacting with the technology. By doing that, they thought that the researcher might take this information back to the software designers to open up more features, to deepen their personal emergent usage. At all times, the researcher reminded them that the study was for research purposes and that he was not interviewing as a representative of the case organization, but it was sometimes difficult for the respondents to understand, especially when the interview process deepened and trust was established. It was initially thought this was peculiar to this research until works of Hagen and Robertson (2010) as well as Boyd (2007) were read, where similar experiences of participants publicizing their identities in the form of self-reporting were noted. While researchers might try to follow protocol and ensure that the identity and data of participants are protected, participants may choose to do otherwise. As put forth by Masten and Plowman (2003, p. 77): “[i]t is clear that the respondents have the rights

to data outside our very limited uses. Their lives are their own; we are only visiting with their permission”.

8.10 Chapter Summary

Table 17 contains the summarized version of this chapter, where the research strategy is specified as discussed, to address the research problem.

Table 17: Summary of the Research Design as it Pertains to this Chapter

Research Design	As applied in Chapters 5, this chapter, and other parts of the thesis
Research Questions	
General Question	Why does emergent usage occur in adaptive information systems?
Sub Question 1	• What experiential factors describe emergent usage of adaptive information systems?
Sub Question 2	• What generative mechanisms must exist for such usage to be possible?
Sub Question 3	• What explains the relations of the mechanisms to effect emergent usage of such information systems?
Philosophical Underpinning	
Ontology	• Critical Realism, particularly the first wave of critical realism with three domains of reality (real, actual, empirical)
Theoretical perspectives	
Conceptual framework	• Draws primarily on a range of relevant IS adoption literature from multi-disciplinary domains to synthesize the conceptual framework.
Extant theories	• Extant socio-technical theories – Theories of CAS and Meta-design
Meta-theory/Ontological framework	• Critical Realism
Methodological approach	
Strategy of inquiry	• Danermark et al.'s (2002) model integrated with Single-Case study (exploratory and explanatory)
Object of inquiry	• Adaptive IS: e-financial service system and its emergent usages
Unit of analysis	• The IT artifact, social actors' actions and activities, perspectives, experiences, and apperceptions in the technology
Data collection	• Multiple sources of qualitative data: participant observations-unstructured and structured; photographs, interviews-semi structured and structured realist interview, as primary sources • Document analysis, blogs, press releases as secondary data • Theoretical redescription as theoretical data
Data analysis	• Developed critical realist data analysis framework with a data coding template that captures the research model • Hybrid thematic analysis that stems from the integration of Braun and Clarke (2006, 2013), Boyatzis (1998) as well as Crabtree and Miller's (1999) versions of qualitative thematic analysis • Data coded in the light of the research model that encapsulate critical realism, for data is not coded in 'epistemological' vacuum (Braun and Clarke 2006)
Research rigor and quality	• Healy and Perry (2000) formulate six epistemic criteria for judging the validity and the reliability of a critical realist case-study: - ontological appropriateness - contingent validity - multiple perceptions of participants and of peer researchers - analytic generalization - construct validity • Ethical consideration

The chapter began by introducing the explanatory case-study used to validate the research model through empirical corroboration. Thereafter, the empirical research work carried out was detailed. This included data collection and analysis, where a critical realist data analytic framework for data analysis with a hybrid thematic analysis was developed. The hybrid thematic analysis stemmed from Braun and Clarke's (2006, 2013) guiding principles. Such a thematic analysis was also interspersed with the template analytic technique of Crabtree and Miller (1999) and Boyatzis (1998), that allowed for theory-driven retroductive analysis of data. The last section of this chapter outlined several considerations used to ensure the rigor and quality of the research outcomes that culminated in a discussion of the ethical considerations. The next chapter will discuss the findings of the empirical work.

Chapter 9

Empirical Evidence and Findings

“The final stage is the assessment and interpretation of the analysis. Have the theory about how the ... [phenomenon occurred] been supported or refuted by the proceeding analysis?”

(Pawson and Tilley 2004, p. 10)

9.1 Introduction

The purpose of this chapter is to report the findings of the two-phase critical realist case-study field work that addressed the research problem: *“Why does emergent usage occur in adaptive information systems?”* The descriptive part of the findings of the first phase were discussed in Chapter 6, in the form of case description and analysis. Three research questions were posed as sub-questions in reference to the research problem:

RQ1 *What experiential factors describe emergent usage of adaptive information systems?*

RQ2 *What generative mechanisms must exist for such emergent usage to be possible?*

RQ3 *What explains the relations of the mechanisms to effect emergent usage of such information systems*

Accordingly, the findings stem from the thematic categorization of the case-study data gleaned from phases 1 and 2 of the research design. The narrative is structured to capture the explanatory and analytical arms of the research model, as shown in Table 18, in the form of its components overview. Besides, Table 18, being the (re)presentation of the research model, scaffolds the answers to the research questions, having offered its

components as concepts for data analysis and “*provisional means of ordering data*”(Layder 1998, p. 108; Morgan and Smircich 1980).

Table 18: Overview of the Components of the Research Model					
Components of the Research Model		Construct	Bhaskar's Critical Realism 3-tier Domains		
			Real	Actual	Empirical
Explanatory Arm of the Research Model (Explanatory Theory) <i>Generative mechanisms</i>	Structures	▪ Embeddedness and Under-design ▪ Information Asymmetrical Structure of the Financial Institutions ▪ Organizational Structure	• • •		
	Mechanisms	▪ Misfits and Workarounds ▪ Technological Cognizance ▪ Technology Mediation ▪ System Affordances ▪ Trust-Distrust Dialectics: Bonded Trust ▪ Critiquing, Reflections, and Learning	• • • • • •		
	Contextual Conditions	▪ Personal Innovativeness in IT (PIIT) ▪ Situational Abnormality and Suspicion	• •		
Analytic Arm of the Research Model (Typological Theory) <i>Experiential non-causal factors</i>	Emergent Usage Experience (UX) Characteristics	▪ User Empowerment ▪ User Satisfaction ▪ Apperceived IS Usefulness ▪ Perceived Deceptiveness of the System ▪ Security and Privacy Concerns		• • • • •	
Consequences		▪ Emergent Usage of Adaptive e-Financial Service-system			•

Since it is not possible to display the full dataset of each of the generative mechanisms and the experiential factors, the research follows Beaudry and Pinsonneault (2005), to construct a few chains of empirical evidence as a replica of what was done in the entire research and place them in Appendix D, Tables 1 to 16. The description of the findings will be rendered in a narrative format, interspersed with quotes from key participants and other supporting evidence, as suggested in case-study research (e.g., Eisenhardt and Graebner 2007). Such a narrative also holds a small amount of existing literature to deepen the analysis and to support the research findings, in order to put them into the context of the previous research (Braun and Clarke 2013). The views of these scholars (i.e., Beaudry and Pinsonneault 2005; Braun and Clarke 2013; Eisenhardt and Graebner 2007) resonate with the critical realist perspective of narrating the findings, which must

incorporate ‘concrete’ empirical data and prior literature, in the light of the theory that was postulated, to explain the phenomenon (Danermark et al. 2002; Pawson et al. 2005). The generative mechanisms retroductively derived from data are not meant to ‘falsify’ or ‘test’ them, but rather to empirically corroborate them in the context where they operate, and to support the findings with literature as an additional source of evidence triangulation (Pawson and Tilley 2004; Wynn and Williams 2012). Consequently, prior literature will be enfolded into the findings, to strengthen the case for the explanation provided by the generative mechanisms.

When a theme is discussed in the narratives, frequency counts are sometimes used to indicate the theme’s prevalence across the data corpus. However, such a count must not be understood as a count of instances of theme’s occurrence (as per content analysis). Rather, it is used to provide some indications of the meanings and the consistency of a theme. *“Frequency counts do not determine value, and whether something is insightful or important for answering the research questions is not necessarily determined”* by the number of times participants said it (Braun and Clarke 2013, p. 261). Thus, the terms ‘most’, ‘frequently’, and ‘some’ are used to capture the extracts of data and the key analytic points associated with the meanings. When ‘most’ is used, it signifies that almost all participants reported the meaning; ‘frequently’ refers to meaning described by more than half; and ‘some’, to less than half the participants. Each quotation is identified by the participant’s identification number.

The description of the findings will now begin with the analytical arm of the research model that captures Bhaskar’s actual-empirical domains, which hold the experiential factors as themes.

9.2 Experiential Factors

9.2.1 Theme 1: User Empowerment

Experiences of user empowerment were described as the overriding characteristic of the system’s emergent usage by most participants. When technology *“informs”*, as Zuboff

(1988) would say, the effects are that users will start to experience empowerment and upskilling. Such empowerment was made evident in the case-study data analysis where most interviewees were experiencing ***panoptic and reflective empowerment***. As two of their comments illustrated:

No matter where the transactions took place or the bank my accounts are resident, I use 22seven dashboard to have a coherent view of my transactions. The interesting thing is that account officers now know that I observe my financial activities, but when and how is not clear to them. After that I used that information to build reports of my overall net worth. With such a view, investment decisions happen at the snap of my finger. (#U1)

22seven enables me to drilldown into my financial activities to see who has done what and when. . . The technology makes it clearer when discrepancies arise and now there is information visibility for the first time in banking matters. With this I can question my accounts officer from an informed position. (#U27)

Apparently, because of the ubiquitous use of mobile internet to access the system, most users interviewed expressed similar experiences. While IS can empower users with fast decision-making capabilities in a dynamic financial market, it can also serve to increase users' control of their finances. Most users interviewed asserted the earlier assumption about the technology empowering users to control their finances, as commented:

With 22seven dashboards on my iPad, I have my total accounts anywhere I go even if I go overseas. With it, I take control of my finance by setting up multiple accounts and view the overall activity without worrying about my monthly account statement. I also prepare my tax returns and submit it from my iPad online. (#U9)

The research data also confirms the ***creativity empowerment*** of the users that goes beyond the notion of simply using the technology. Finding new ways of using the technology to accomplish goals were experienced by most users interviewed, as commented by one of the interviewees:

22seven gives me access to compose solutions to my needs. <How? The researcher asked> I usually used its location widget and integrate it with my iPhone GPS to locate the nearest ATM of my bank. You know interbank ATM services charge a little higher. So I insist on using my bank's ATM wherever I go to save cost. (#U12)

Experiences of empowerment were mostly evident when individual users actualized their new ideas about how the system features could be used and these ideas were encouraged to be put into use by the designers in the organization. One of the designers interviewed had this to say:

We foresee what they might need and provide the content and the tool to help them. In that process, we also learn from the users. Most times we see some fantastic maneuvering of the features of our website by our users to achieve their individual goals, even to our bewilderment. Aha! It gives us encouragement that we are in for something. (#SD1)

Besides, the totality of the empowerment experienced by users encapsulates emotions and experiential reality, as summarized by a user:

The empowerment I experienced in the 22seven has motivated me a lot and most times I feel very happy and rewarding that I could use the technology in that way to meet my needs. (#U30)

The finding echoes previous studies which have demonstrated users' panoptic and reflective empowerment capability of workplace systems (e.g., Elmes et al. 2005; Kayas et al. 2008). Although in a different context, the research findings somewhat resonate with such previous work, where it is demonstrated that empowerment experiences allow users to be expressive, surveillance over their financial activities, reflective, and engage in profound meaning-making in financial matters. Users are no longer passive, but viewed as creative users of the structures of IT to achieve banking activities surveillance. Such activities are open to interrogation by the customers themselves without banks' assistance, using drill down to identify any pricing or deduction errors, who made them, and when they were made. It summarizes how users construct meaning and contribute

their interpretations of what a system portrays to them, and make their own choices, rather than being told by a system what they should be experiencing (Karapanos 2013; Orlikowski 1992). In doing that, the system triggers users' emotional and experiential reality of self-determination, motivation, and excitement associated with creativity (Hassenzahl et al. 2010; Wixon 2011).

9.2.2 Theme 2: Apperception of IS Usefulness

Experiences associated with *apperceptions* about the usefulness of the technology were predominantly positive. Almost all the users examined agreed that the system was very useful because of experiencing or having a mental content of its ***appropriateness in the context*** in which it was used. They noted that the system fitted their goals, as summarized in one of the interview excerpts:

The technology is indeed useful. One time I really needed my bank's ATM in Grahamstown Art festival I hadn't visited before . . . so I whipped out my iPhone, fired up 22seven location widget and mash it up with my iPhone GPS. Quickly, here comes the ATM at the other side of the street I just missed. That got me in a better mood; I walked back to that street and get some money. I was amazed about technology and the time it saves. (#U23)

Such emergent usage would not have been possible without accumulating and giving meaning to the experiences of innovative IS use, instead of just perceiving its usefulness. Also, the data confirm the ease of reconfiguration due to the users' *apperception* of the technology. It indicates that the system enhanced users' overall experience of flexible reconfiguration, as one of them indicated:

Tweaking the website on my iPad to understand my income-to-debt ratio at all times is a positive experience. A widget is there for me to do just that without any assistance. I create budgets based on my financial goals, and the technology shows my actual spending versus what was budgeted. (#U27)

The mental content that holds such usage experience has a functionality that reveals the reason why an aesthetic user interface is incorporated into the system to exploit its usefulness. The user interface allows for quick access to information, as frequently noted by users (e.g., *"I have easy access to my financial transactions from my iPhone"* #U11) and it is logically organized to make sense (e.g., *"I'm not confused by the information highlighted"* #U10) on a stimulating and intuitive interface that is *"... laid out as in real life for me to see"* #U28. With a **visually attractive** interface that appears to be well crafted in suite colors and readable fonts, users expressed the beauty of the interface (e.g., *"... very inviting interface"* #U29). Its importance for yielding aesthetic values, was also seconded by one of the designers:

Our visual design turns users on to complete their tasks and maximize the widget functionalities. We are aware if the application doesn't have the right kind of aesthetic value, it will not only fail to attract the user's attention, it will also fail to hold their attention. (#SD2)

The usefulness of the system is also attuned to *pleasurable interactions* while accomplishing a task. There are a number of ways users frequently confirmed that the technology-in-use achieved *pleasurable interactions*. From offering a sense of recognizable environment (e.g., *"it looks like internet banking website"* #U14) to gamification-based interactions in a business-minded financial website, a user had this to say:

There is a refreshing sense of adventure when using 22seven to check my accounts. I love the encounter of income and expenses presentation – very graphic and gamified. I had mixed emotions: "Whoa, did I earn that much?!" was followed by "No, no, no, where did it go then? To, yes, yes, yes, here it is, you spent it and none else, oho!" (#U19)

As the interaction lasted, intrusive ads were not allowed except if the user opted for such a service and this seemed to increase the ***pleasurable interaction*** experience (e.g., “. . . *unlike others, I don’t get unsolicited ads while I’m using the technology.*” #U5)

Findings suggest that users *apperceived* the usefulness of the website, due to its malleable structures that could be reconfigured, based on accumulated experiences. Such a reconfiguration is in tune with the system’s context-of-use in a task-oriented environment that is spiced with emotions (Rousi et al. 2010; Saariluoma et al. 2009). Most times, such a context is determined by the idiosyncratic requirements of the individual users or individual psychological values. Altogether, such findings confirm the earlier assumption that the usefulness of a system cannot be separated from the context in which it is used, *apperceived*, and appropriated for emergent use.

9.2.3 Theme 3: Security and Privacy Concerns

Experiences of privacy concerns and the need for having information secured were emphasized by most interviewees. The participants were concerned about what might happen to their banking details, about their interactive activities, where the content would be saved, and who could eventually access the content they had created. Thus, security and privacy concerns became the anticipated experiences users mostly expressed before signing in. The following quotes illustrate this point:

Security and privacy concerns are the reasons most bank clients don't use 22seven. My personal information could be used without my knowledge. Laying bare the details of all your holdings in one place is a scary thought, since it would only take one shrewd hacker to get his grubby hands on the data and wreak havoc. It's like keeping your ATM card and PIN ID in the same wallet. It's just bad personal security. (#U20)

Yeah, they told me that my 22seven account is anonymous; set up requires only an email and my password, but my question really is why does it then ask for my bank details? No way in hell, am' I gonna log in into 22seven again. (#U28)

These comments basically attest to the fact that security and privacy concerns are common challenges in adaptive IS for e-financial services. However, despite such

challenges shrouding the system's usefulness, user-system interactions continued to be seen as positive by most people interviewed. A household user commented:

Individual's risk averse has its role in 22seven. That is certain, but to us, we use the system despite its envisaged security challenges. A mobile app that gives you a self-audit of your financial position might not be found elsewhere in SA [South Africa]. Besides, if hackers could break into 22seven, the same could be done with my bank's database since they use the same security encryptions like the banks. (#U15)

Caution was exercised by some participants, as suggested by the data, for fear of identity theft and, as such, they used the technology sparingly. The system's request for banking details also escalated such caution, fueling fear and anxiety among users (e.g., *I'm afraid to lose my bank's PIN numbers to internet fraud #U22*). Besides, the objectivity of the security infrastructure deployed by the organization was subjectively interpreted and did not necessarily correspond to users' perceptions. One of the software designers commented:

Issues of security and privacy risks are serious concerns for us as designers and that's why we placed our privacy policies on our webpage. We have also deployed bank level security in our network and we don't see it being compromised. <Why the researcher asked? >, we don't keep deposits, and even users' banking details are not with us, they are encrypted and stored by Yodlee. So breaking into our website is not rewarding to any hacker. All these we have done, but whether our users see it that way is a different ball game. (#SD5)

Access to the website via the smart mobile device has redefined privacy concerns to be relative to social surroundings and spatial contexts of users (Chua et al. 2011; Knijnenburg et al. 2012). Spatial contextual issues and socialness of the users inhibit the emergent usage experiences of the application due to the privacy concern. A user commented:

Some information is more sensitive than others, especially money matters. I find it quite uneasy with 22seven on my iPad when with my partner, you know what I mean. <The interviewee pauses, smiles . . . and then exclaims . . .> Damn! there is no hiding place, men! (#U8)

Security and privacy concerns continue to be a major challenge in e-financial service-systems and are less problematic when security and privacy features are well-designed (Chua et al. 2011; Featherman et al. 2010; Yousafzai et al. 2009). Thus, negative perceptions of security and privacy are heightened when these features are badly designed. These concerns are noted when actual usage of the system occurs, and are dependent upon the contexts-of-use. Similar to prior studies (e.g., Awad and Krishnan 2006; Xu et al. 2011), UX in the research findings seems to be based on a trade-off between positive/useful interactions and security/privacy concerns. Such concerns may reduce users' positive experience, but the system's stimulating rewards compel them to continue to appropriate the technology.

9.2.4 Theme 4: Perceived Deceptiveness of the System

Most users were alerted to the potential deception of the system (i.e., website). They engaged with the website's personalized service, but recognized that such services could **conceal** the organization's intent of advertising and selling financial e-products. As summarized by one of the users interviewed:

Nothing is free sir <I guess he is referring to the researcher>. They put up these fantastic personalized services to bring repeat traffic to their site, but they end up luring us to sell mutual funds and home loans. (#U18)

The website's financial e-products were also perceived to be **equivocated and concealed** in the personalized services of the system, with the potential to deceive. The users considered such services as having persuasive effects. A user commented:

The website promotes Old Mutual savings and mortgage services. True mortgage rates might be compromised. False ones padded with hidden costs to look cheaper among alternatives. So I must make sure the website is not for bait-and-switch tactics. (#U16)

The **falsification likelihood** of the website was frequently pointed out by competitors such as the banks, in order to gain undue advantage and dissuade potential users of the technology. For instance, a bank manager interviewed noted: “*We make a living out of protecting the customers’ money. Now with this new idea that has come to stay looks deceptive. The fact is that it would be hard to know what the company [22seven] would be tempted to do with our customers’ information.*” #U20. Being a competitive and disruptive technology, banks engaged in narrow and self-serving, opportunistic behaviors, by means of guile, to discredit the services of the website. One of the managers of the case organization stated:

I think that these deceptive rumors about our practices exist because we have strained relations with certain banks, and today I suspect that they may be tempted to indulge in acts of opportunism even though we are governed by the highest ethical standard. (#M2)

Users interviewed frequently confirmed the self-serving, opportunistic behaviors of banks in labeling the website as deceptive. A user summarized it as follows:

Banks are making us believe that 22seven is deceptive because they don’t want their excessive fees they charge on the person’s account exposed. In my case, I use 22seven to monitor them. Unfair deductions of overdraft fees are alerted and I called for reversal forthwith. 22seven is hidden bank fees buster, trust me! (#U17)

Having noticed the anomalies in the e-financial environment, users attributed the deceptiveness of the website based on situational cues (Mavlanova et al. 2015; Xiao and Benbasat 2011), which triggered their negative perceptions. In resonance with prior studies (e.g., Charki and Josserand 2008; Xiao and Tan 2012), such perceptions generate interpretive hypotheses of concealment, equivocation, and falsification without certainty (Xiao and Tan 2012).

9.2.5 Theme 5: User Satisfaction

Despite the security challenges and the perceived deceptiveness of the website, due to situational cues, the general belief of users was that they were satisfied with the technology. From the thematic analysis, satisfying user experiences were clustered around *need fulfillment in the context-of-use, reliable user interface, stimulation and novelty, and organizational supportiveness*. The ***need fulfillment in the context-of-use*** referred mostly to psychological needs of autonomy and relatedness among the household users. Expressions of how satisfied they were when the technology allowed them “*to do things their own way*” and gave them “*the choice of banking activities based on their interests and values*” were evident. Apart from autonomy, the technology gave couples a strong sense of intimacy, openness, and honesty with their partners in financial matters. A couple summarized it as follows:

We are very satisfied with 22seven on our iPad. It helps us keep it together as a young couple. We use it to manage both our personal and business lives. We enjoy having a good time doing it together. We can take control of our financial lives with the same sort of honesty and ease we've grown accustomed to in other aspects of our lives. (#U26)

Other non-couples expressed their satisfying usage experiences as more due to the system's adaptability to the context-of-use. The system's ability to meet information needs that were triggered by contingencies and contextual factors also engendered satisfying user experiences. An on-the-move business investor interviewed noted:

22seven FOREX info on my iPad is handy, current and reflects the SA financial market. I'm happy using it for my day-to-day trading business instead of relying on my daily inquiry from an officer at a nearby bank. With its currency calculator, I can quickly have a feel of any country's money when compared against the Rand. (#U18)

As far as the user was concerned, a ***reliable user interface*** is the product. Good user interface performance added up to the satisfying and intuitive experience. Since the

system's access devices are mostly smart mobile devices, creation of customized services demands a reliable, flexible, and functional user interface. Users are dissatisfied and disorientated with interfaces that are not easy to understand, non-supportive, or lack that perfect match between user tasks and the widget functions on the screen. From the research data, most users felt very satisfied with the interface that was easy to understand (e.g., "[t]he interface is easy enough to understand, just drag the widget icons to the task icon and tap submit, it's simple," #U6), flexible and intuitive (e.g., "very satisfying interface and I can undo my previous move with speed" #U4), as well as being supportive (e.g., "flashes me with helpful feedback if an error is encountered" #U9).

User satisfying experiences are also triggered by emotional and/or hedonistic values such as **stimulation and novelty**, which are also prerequisites for individualized development of personalized products in the technology. A user noted in the interview:

One of my satisfying experiences is related to my creating a dynamic dashboard of my financial transactions <Come I show you, on my iPad, the interviewee requested, no . . . no . . .! Don't worry, the researcher replied>. I especially liked the feeling, when I thought of my financial behavior. I could see it in a minute if there is any transaction in my accounts in a colored graphic map here once I initialized it. There is also a great feeling of novelty involved, as I had not used such a financial vision before. It is really a great tool! (#U27)

Achieving high levels of user-satisfying experience requires that organizations continually monitor and examine their technology, in response to emergent usage experiences. One of the software designers interviewed commented:

We fine-tune the website content on the basis of local adaptation of each user to keep them satisfied and also respond to their feedback promptly. We know when features are performing well and are providing the increasing engagement of that very user. (#SD3)

Thus, the organization acts to satisfy users in an environment where the users themselves exercise ultimate influence. Thus, their satisfaction depends on *need*

fulfillment in the context-of-use as indicated by previous work (e.g., Scheepers et al. 2006), *reliable user interface, stimulation, and novelty*, as well as **organizational supportiveness** in updating the website content *and* constant monitoring of information quality.

Altogether, five key themes (*i.e., user empowerment, the apperception of IS usefulness, security and privacy concerns, perceived deceptiveness of the system, and user satisfaction*) are identified as the experiential factors that describe emergent UX of adaptive IS. The case-study findings suggest that the meanings associated with UX can only be understood in contexts-of-use. While meanings for most participants were tied to the situational context in which the technology is appropriated, it is shrouded in emotion and experiential reality in a task-oriented domain.

Similarly, the report of the research findings will now shift to the underlying generative mechanisms. Such mechanisms were postulated to have caused these experiential factors to become in the actual domain and were observed as the system's emergent usage in the empirical domain. As shown in Table 18 that scaffolds the answers to the research questions, the discussion will start with the enabling structures from the real domain.

9.3 The Enabling Structures

9.3.1 Theme 1: Embeddedness and Under-design

From the case results, evidence of embeddedness of IS structures were found. Such structures are the loosely latent-based artifactual structures (*i.e., ostensive routine*), necessary for the basic functioning of the system and that constitute the system features. Most meanings made out of the data suggested that individual task routines were embedded halfway into the IT artifacts, to form material agency that were exerted by users. One of the software designers commented:

First, we script prepackaged tasks functionality that provides value to initially entice and hook end-user communities. The final ingredients are left half-way for them to fill, using their widgets in their contexts of use. At times, we noticed abandonment of the process, but most times users continued, because of the rewarding value in accomplishing the tasks. (#SD3)

By specifying that the embedded structures of the IS innovation are scripted half-way confirmed the fact that the structural potential of the technology is under-design. This allows the technology to be fully constituted while-in-use. Such a structure also assumes autonomous entities with latent rules and resources for human action. For instance, one of the designers commented that “[they] develop content that conform to transactional banking routines in the website and thereafter users can incorporate it to create solutions”. #SD1. Thus, by incorporating such a structural potential, the technology is given causal powers to be appropriated (performative routines) by the users, as noted by one of them.

I usually create tags to add comments to my spending transactions that weren't specified in the website. The beauty of the comments is that it provides the context wherein the transactions took effect. Last month, I paid a traffic fine in Cape Town so it shows up on my transaction list as Cape Town. Then it is categorized automatically under grocery which is okay because I don't want to create a separate category for fines. So what I did was to attach a 'note' on the transaction reminding me what it was. Over time the technology recognized my comment tags and automatically creates it for me once I tapped on the widget on my iPad. (#U21)

This excerpt also confirms that the user's goal is not merely about IS use, but also for emergent interactions, in order to communicate “with the world in which we act, and which acts upon us” (Dourish 2001, p. 116). The automatic recognition of the user's created tag and its subsequent affordances by the system: (1) recognizes the under-design postulation and the surreptitious evolution of the system while-in-use (Fischer and Herrmann 2011), (2) strengthens the re-framing of users as designers-in-use or creators of software structures (Germonprez et al. 2011; Volkoff et al. 2007), and (3) confirms the fact that the software design process does not end when a system is

implemented (Germonprez et al. 2011; Giaccardi and Fischer 2008). Since the technology is not infinitely malleable, software designers, script structures of legitimation control and account for users' activities as part of the embedded structure. The chief business analyst at the case organization commented:

We take the scripting of codes that govern the functionality and the domain of users' responsibilities very seriously. That also includes contractual agreements, institutional laws, security, and privacy policies that guide users' behavior. Since we do not have the in-house expertise of scripting such codes, we outsource them to Yodlee who provides us with bank level security that we link to the functional routines of our system. (#SD4)

The data excerpt captures the fact that the structures of legitimation also include security and privacy programs that must exist in the technology, in order to ensure compliance. This fosters the surveillance mechanism that users are aware of and ensures that the users are vigilant about the security, privacy, integrity, and confidentiality of the system's content which, in turn constrains their emergent usage experiences and behaviors.

9.3.2 Theme 2: Information Asymmetrical Structure

The acuteness of the information asymmetrical structure between the banks and users of the technology constitutes one of the enabling structures of the system's emergent usage. The case result suggests that the financial ecosystem in which the technology is situated manifests domineering power relations that the banks exploit, due to information asymmetries. One of the users of the technology noted:

Our deal with banks in SA is opaquely done and it has been so for ages. I have no other option than to engage with 22seven to confront banks' secrecy of servicing my accounts, since they don't embrace the idea of accessibility. Banks in SA lock clients into their foggy ecosystem – and that mentality is being exposed by 22seven. (#U5)

As CAS theory attests, information asymmetrical interactions could cause adaptive behavior to emerge (Cilliers 1998; Uhl-Bien et al. 2007). Therefore, users adapt the technology to various use situations in order to confront the asymmetrical interactions. The case-study findings also suggest that such interactions are conspicuous when it comes to non-transparency of bank charges on loan servicing. Although, banks usually emphasize the importance of transparent pricing, it is difficult for them to implement this in practice. This has resulted in misleading flat interest rate calculations, resulting in the system's emergent usage being seen as a platform that provides the granular transparency for users' loan interest transactions. A user's experience summarizes it all as:

A de-service that needs to be challenged for it has been the norms for us to notice the discrepancy between stated interest rates and actual interest charged. Take my own case, for example; my bank's interest rate quoted before contracting the loan was 4% per month. Instead of translating to 48% it surreptitiously turns into an annualized percentage rate (APR) greater than 90% when the details are exposed by 22seven in the following manner. First and foremost, the interest is calculated at 4% based on the initial balance of the pay down principal. Instead of the monthly charges, the interest is charged every four weeks to arrive at a 13 payment cycle within one year rather than 12 as contractually agreed. They also charge 2% as a mandatory savings provision, which comes out of the initial loan amount. This is excluded from the 4% specified interest on the total loan amount. Thereafter, an upfront fee, for operating or servicing the loan is deducted from the loan received and also included in the interest calculation. In the entire process, I was in essence charged a 90.8% APR on a loan advertised as 4% when I used 22seven to compute it all. Do you see how I was ripped off?(#U16)

With the understanding that transparency is generally low, users embrace the technology to achieve greater transparency, compare loan offers to get competitive offers, and avoid those banks masking the true costs of their loans. Other key manifestations of asymmetrical information that most participants commented about was the non-transparency of tariffs and banking fees (Hedvicaková and Soukal 2012; Kajtazi et al. 2011). Since such tariffs and fees are mostly hidden behind the shroud of non-transparent fee structure, users adopt and adapt the technology for monitoring their fee charges on their bank accounts. A user commented:

I recently signed up with 22seven to monitor my ABSA business account and I have been watching with shivers as they suddenly hiked up all my fees, without informing me. Now, instead of the flat fee I used to pay for all transactions, I've begun to pay what appears to be a percentage-based fee for two years. Not once did they bother to ask me about it, let alone give me a call. I have to ring them up to have that reversed. (#U11)

The extent of securitization of mortgage loans in the financial market, without due approval from the borrowers, was expressed by some participants as the root of this information asymmetrical structure. Some entrepreneurs, who are also users of the technology, do not want their loans to be securitized by their banks. Therefore, the technology provides the enabling tool to monitor such happenstance, since there is usually no tool that would alert clients about the securitization behaviors of their banks. One of the entrepreneurs interviewed had this to say:

I must commend 22seven for helping us to regain the visibility of our mortgage credits with different banks in SA, the service banks should have probably given us. They compel us to relate with them blindfolded probably because too many of them appear to have read Adam Smith's "wealth of nations" and totally ignored his "theory of moral sentiments". Otherwise, how could one explain the securitization of my mortgage credits without my consent, only to be alerted by 22seven here on my iPad? I foresee that happening so I configured the website to monitor it for me. Even when I called my account officer, she claimed ignorance of such. You know what that means, my contractual obligation has shifted from the bank I took the loan to now an unknown investor that purchased the security. Presently I have informed my lawyer and we will take it up from there. I'm really peeved about being left out of the whole deal. (#U13)

Finally, users need a technology with a built-in business assurance, to provide the much-needed transparency of customers' banking transactions. The case organization saw this business niche as a very viable option and launched the technology in the South African financial market. The chief business analyst of the case organization noted:

Customers want to have visibility and gain control of their money. It is rather unfortunate that banks better positioned to do so are very reluctant in providing them that facility. Rather, technology is used more to themselves instead of focusing it on the customer. Also, due to the democratization of information, customers are demanding their right to information, especially their financial information. When we see this, we cash in on it to develop 22seven.com. (#M2)

Part of the case-study findings resonate with a previous study (e.g., Hedvicaková and Soukal 2012) that revealed how banking fees in the Czech Republic are shrouded in the non-transparent fee structure. In the case under investigation, such a non-transparent fee structure is also unveiled by a similar technology. The technology is deployed to bring tariff transparency and easier product comparison for users' decision-making and investment planning (Hedvicaková and Soukal 2012).

9.3.3 Theme 3: Organizational Structure

The case-study findings support organizational structure with fluid routineness as an enabler of the system's emergent usage. Without such a structure, it would be practically impossible to adapt to the volatile financial market, which conditions users' unanticipated interactions. As the chief business analyst and the chief IT architect could attest:

We can only survive with an organizational structure that enables us to adapt to the financial market pressures. Our structure prioritizes individual interactions that most align with market volatility. With such a goal, we can respond to changes in the technology. (#M2)

The e-financial market is embedded with volatility, so we need to precede market demands with organizational adaptability. If we don't have a structure to support that, then we will be out of business. (#M3).

Communication and collaboration among designers are intertwined and constitute the effective ingredient for a fluid structure in the case organization. The data pattern clearly shows such an intertwinement thorough the regular stand-up meetings and co-location of team members with different specialties. This allows team members to exchange ideas and to provide assistance for themselves and the users.

Below are a few comments provided by the software designers during their interviews.

Collaboration among team members is critical and we emphasized it during our regular stand-up meetings. Each member has a voice that must be listened to. We are at ease to share opinions and ideas despite our varied expertise. A team can reach out, without problems, to other teams for support as this is an ethos that extends beyond the organization, even to our users. (#SD3)

We take the issue of collaboration and communication too far, even at use time. We see 'usage' as the system in communication or in collaborating with the users. Therefore, errors occurring in the system are signs that the system is not in collaboration, no matter how the user swings the system, especially within the windows of our design. So we design to eliminate system malfunctioning through knowledge sharing among our diversified teams and users. (#SD4)

As the diversity of expertise among team members is noted, the research findings reveal that, without such diversity, it would have been difficult to understand the variety of user requirement changes that align with contexts-of-use. Besides, the trust between team members was utilized in coordinating such diversity for addressing unanticipated uses. A software designer noted:

Our structure – obvious the underlying collaboration among diversified teams and the trust they have among themselves. Because of that we are better positioned to respond to users' unanticipated uses with people that have different levels of experiences and different skill sets. (#M2)

Diversity of expertise can also facilitate agile responsiveness through accelerated problem-solving, due to readily available expertise and skills.

With our experienced and diverse teams, user support is highly responsive. Our users appreciate us when we diagnose their problems while on the phone or chat and then push out the fix just a few minutes later. (#SD5)

Such agile responsiveness is occasionally stalled when users' changing requirements do not stay within the planned boundaries of the system, or when they deviate from the organizational goal.

Some of our users want us to add additional features, which were never in the scope of our business, or we found it to be unethical or constitutes a security breach. We said, "No" to such requests. (#M3)

However, if a user's changes are both technical and functionally viable to enhance the system's service quality, findings suggest that the case organization addresses such a request almost immediately, regardless of time and cost constraints.

We really respond to user changes that are truly goal driven since we cannot claim to know it all. Regardless of what it will cost us, we immediately pick out the domain experts from our pool of experience designers that knew best about the problem. They come up with the script, test it, and educate us about the security implications from a usage perspective. Then we implement it only on that user's space and monitor it. When we realized later that our users might need such a change or content we generalize it to all. (#M3)

Users' attestation to such an organizational structure could be summarized by one of the users:

The knowledge of certain aspects of the website was something I didn't have but when I ring them up I got a response immediately. You know, these days, contacting an online vendor for support can be frustrating. But 22seven is a pleasure to deal with. I found their support team extremely knowledgeable in financial matters. They are creative in trying to identify solutions to my problem when I tried to build my self-audit dashboard on my iPad. I have a great deal of confidence in their abilities. (#U9)

Thus, the data excerpts suggest that the system's emergent usage is highly dependent on the fluid organizational structure. With such a structure, communication, collaboration, diversity of expertise, responsiveness, and management style of leadership become powerful forces that galvanize and foster the system's emergent usage. By this, the earlier assumption that adaptive IS emergent usage is highly dependent on the

immediate activities of the organization that deployed the system is being confirmed. Also, the blurriness of design time and the use time is supported by the research data to some extent. The diverse designers are constantly working on the system to mediate and facilitate users' appropriation of the system in their various contexts-of-use. By doing that, individual emergent usage is seen to be driven by the structure of the organization that made it available for users in the public domain.

9.4 Dynamic Mechanisms

This section contains the research findings that are associated with the dynamic mechanisms responsible for operationalizing the system's emergent usage. It will start with misfits and ease-of-workarounds

9.4.1 Theme 1: Misfits and Ease-of-Workarounds

The case-study uncovers important findings about users' emergent behavior in response to experiences of system misfit. Most of the research participants interviewed confirmed that misfits exist by default in the system. The system features do not map perfectly with the expected task accomplishments, e.g., (*"I always have to adjust its contents to a finer detail before I could get what I want."*#U12). Such a misfit is to capture each user's context-of-use in which changes, both intended and unintended, take place. Since designers cannot anticipate and design for every possible situation, the technology evolves while-in-use, to some extent. This gives the owners of problems the ability to modify them. The following quotes from the chief business analyst and a designer, in their separate interviews, illustrated these points:

We develop customizable built-in contents to a certain degree. It might not match users' needs quite right. But users can adapt the contents to meet their specific financial activities. (#M2)

Our website is designed for you to create financial service solutions in tandem with your financial behaviors. Our system can never match each individual's needs, and I don't think any system can perfectly claim such. We provide the basic structural features and users complement us by building on it to customize their needs. (#SD1)

The research findings reveal that the system exhibits ease-of-workaround for users to navigate around the system's apperceived misfits. By this, users accomplish tasks in ways that do not contravene formalized system policies or security standards. Besides, the findings also support the proposition that experiences of system misfits encourage the adoption of IS workaround practices. A plausible interpretation is that apperceived system misfits encourage workaround practices, in order to achieve system emergent usage. As one of the software designers and a user attested:

System misfits are usually experienced by our users, but I can assure you as a support staff that our users know how to get around it in their own ways. We noticed most of their activities in the activity log on this console. Extreme cases exist where they call and we assist them. If the contents are not there, we create it for them in the shortest possible time, if functionally viable or necessary. (#SD2)

I can easily work around the system to fit my financial behavior. Now that I have some knowledge of its features, I create more tags to accommodate my spending habits without assistance. With 22seven, I have also tied my Nedbank savings account with my actual spendings so that I don't overspend. I created a grocery budget from that account for my wife this Christmas to enable her spend wisely . . . With this, our financial prudence has tremendously increased and we now can save more. You know I can't get it elsewhere, like this. (#U13).

Altogether, the data excerpts suggest that the technology is designed for managing misfits with an inherent customizable pattern, within the confines of the system's security policies, around a user space. Users therefore work around or tweak the system to adapt or appropriate the technology, to accommodate their unique and varied

banking activities. Despite the differences in the IT context, the research findings resonate with previous studies (e.g., Boudreau and Robey 2005; le Roux 2014) which reveal that users' experiences of misfits in ERP systems trigger users' reinvention practices. However, the embedded structures of misfit introduce adverse effects and constrain users' ability to achieve system emergent usage. The most common complaint was that the system does not allow multi-tasking operations. Only one task could be open at a time and it was frustrating for some users, who were accustomed to multi-tasking, which the technology did not allow for.

If you initiate two tasks at a time the website isn't gonna take it and it kicks you out of the system completely. So you end up starting afresh and initialize the system before coming in. Often it locks you up and you can't use it for some time because the stupid application won't take it and you have to call 22seven. (#U29)

Besides the likes of this kind of problem, the system misfits empirically provided good support for system emergent usage, with a few constraints that the designers considered as those the system design allowed, and some which were seen as emergent and that needed further rework.

9.4.2 Theme 2: System Affordances

While there are other sources of affordances, the focus is on the user-system relation. This included *service value creation affordances*, *visualization value affordances*, *pedagogical affordances*, and *mobility affordances*. Each affordance cannot be actualized, except where there are system features (i.e., embedded digital capabilities in artifacts) that support such an affordance and the users' capabilities that enable or constrain the actualization of the affordance. Thus, the user capability ***PIIT (perceived innovativeness with IT)*** is the enabling causal condition necessary for actualization of each of the affordances. Each of the affordances is discussed separately as follows:

Service value creation affordances

The case-study findings reveal that there are service value creation affordances. Frequent comments from participants suggest that the technology affords value co-creation through ‘*value constellations*’ of services that are dispersed in other firms’ websites, to achieve value unique to individual contexts. Hyperlinks and RESTful web service compositions, wrapped-around a widget icon, provide the technological capabilities that support this affordance. The experiences of some users captured the actions permitted through such capabilities:

I had wonderful experiences with 22seven, but one always comes to my mind. <How? The researcher inquired>. I used 22seven to set a goal of buying a car and the tracking of my progress some time last year. It got to a point I felt I can buy the car; I clicked 22seven car dealers’ hyperlink and highlight my choice car and also I swing backward to experian.co.za to check my credit score. I booked my car loan at Nedbank after comparing interest rates with other sources with 22seven website. The next two days I got an email to visit any Nedbank branch nearest to me, which I also used the location widget of 22seven on my iPhone to locate. There, I signed off the necessary details and after a few days I got this car [the interviewee pointing to a sleek Toyota Auris Hybrid]. (#U10)

I used 22seven Pay Bill widget to split bills between my roommates across different internet banking websites. <How? The research inquired>. Each of my roommates sends their money from their respective banks to my e-wallet and I rolled the balances over to our landlord’s account monthly. (#U24)

These statements expose how web service and hyperlink functionalities of a widget icon on the user interface created a space for actions that were related to service value creation, and which permitted transparent recombination of services (Hovorka and Germonprez 2008). When actualized, it generates greater utility-based emergent usage of the technology, due to the attraction of partners (Bygstad 2010). This finding resonates with previous studies (e.g., Bygstad 2010; Cenamor et al. 2013; Lee et al. 2010), which revealed that organizations influence individuals to adopt their IT platforms by leveraging benefits from the strategic joint integration of a related innovation or complementary service.

Visualization value affordances

The research findings also reveal visualization affordances especially when users engage the technology's analytics to make sense of their personal financial data in the user model. The technology's analytics afforded by the system explain the action possibilities for extracting value from the real-time streams of personal account activities, in the form of transactional data. Such data are from multiple sources of account activities across the geography of banks and other financial institutions in South Africa. The multiple sources of account data are given a single interface, with new levels of granularity that have previously been opaque. To achieve such a single interface demands that the user model is automatically updated, when users commit any financial transactions; it is also accessible in real time through an API widget. Both the user model and the analytics tools provide the technological capabilities that support this affordance. A user commented:

With the user model, I built a dynamic net-worth on my iPad. With the analytics tool, I drilled down to granular details. As at present, my net-worth connects directly to my financial transactions as in one place and it's always up to date. This reduces the potential for errors and I'm certain about its information for making investments and spending decisions. (#U27)

The case data also reveal that visualization affordances gave the users opportunities to keep a close watch on their finances. To watch over financial affairs is crucial for several reasons. For those holding account services, it is important to be aware of anticipated withdrawals to avoid overdraft interest charges, review account statements, verify the authenticity of deposits and withdrawals, or fee deductions. Even for those who hold investment accounts, it is important to oversee that savings are safe; interest accrued is correctly credited to accounts. The personalized budgets and visualization of income and expense functionalities provide the technological capabilities that support this segment of visualization affordances. Most comments from participants concerning this are summarized by the experience of one user.

Yes, 22seven assists me to watch my accounts across banks – found two 'hideaway' debit orders below the R100 threshold running for 2 years, yet no notification from my bank. Also, banking fees are being watched like a hawk and will give me the opportunity to jump if cheaper accounts pop up. Being able to see my net-worth slowly growing every day is also a positive counter. One day I hope it's in the plus range. (#U25)

Pedagogical affordances

With modern consumerism that encourages less frugality, the pedagogical affordances of the technology stem from the financial education it provides to users for financial prudence. The investment/financial planning, tax management, click-and-chat feature, and home buying/personal banking functionalities provide the technological capabilities that support pedagogical affordances. Most of the findings suggest that pedagogical affordances hinge on the financial education about saving behaviors offered by the technology, with a disclaimer that the site is for informational and educational purposes only. This assists users to build personal financial security via savings or investments and reduce the reliance on credits from an informed perspective. Such education reorients users' perceptions to understand that savings are intentionally planned, rather than a default position due to cash-inflows. One user said:

22seven provide us with information about the extent to which an individual can begin a savings or investment plan. For me, I usually engage their online financial expert in click-to-chat discussions on the best plan. I see the advice as valuable, non-biased and non-persuading, though there is a disclaimer in case of harm caused by using their advisement. (#U26)

The case data also indicates that the pedagogical *affordances* are also offered in the area of educating people to choose the right financial products. Such affordances provide the action possibilities that permit users to make informed investment decisions. The technology offers alternative advice independent of the banks' consultancy, to enable investors to choose appropriate products that meet their needs in a cost-effective way, for example:

22seven gives me a lot of knowledge about personal finance. I started enjoying their investment and saving opportunity advice for some time before thinking about signing on with my bank or with Old Mutual, but I finally got Old Mutual to sign me up. (#U27)

Mobility affordances

With its ubiquitous Internet on tablets and smartphones, the mobility affordances of the technology can support the versatility of its emergent usage, which does not otherwise exist with less portable devices. Based on this, most participants ascribed its mobility affordances to how it supports their professional values of immediacy, personalization, and action. An observation of a physically-impaired business executive, who was also a member of the user group, follows:

He has an iPad strapped on the left arm of his wheelchair with his able left hand, he swipes across 22seven widgets while confined to his wheelchair. And through that adaptation he is able to interact with the technology and access his accounts. And when interviewed, he stated, "It brings an immediacy and personalization to banking activities which otherwise wasn't there. Unlike internet banking, I don't have to hop around each bank's website where my accounts are, I just get them from one source." (#U16)

The case data also show that the technology's mobility affordances have interwoven into people's lives and, as such, its transformation experiences cannot be ignored. One of such technology's mobility affordances revealed by the data is that couples with joint accounts developed further intimacy through the use of the technology on iPad. This has afforded couples a focal point for conversations and a greater opportunity to discuss financial matters. A couple with a joint business account had this to say:

When 22seven on iPad comes home it is just like a follow-up in the office, but with more relaxed and intimate interactions with my husband who understands investment matters. What we saw in the office can be followed on at home in a relaxed mood, which is really important. (#U6)

Another couple stated:

I'm a contractor that knows little about investments. But when 22seven on my iPad comes home, my wife will show me investment plans, she will point out some viable ones to me, show me how it works and at the end, I signed up with Old Mutual and I'm happy seeing how our investment grows. (#U14)

Other mobility affordances of the technology revealed by the data centered on contextual-sensitivities, (e.g., *"I used it anywhere, anytime . . ."* #U30) and individuality of users, through their choice and emergent use, (e.g., *" . . . it makes me recognize the personal nature of my finances"* #U8, *" . . . allows me to customize it and gives the pedagogy that suits my learning aspirations in financial matters."* #U21).

Obviously, these affordances depend on the embedded material properties of the technology that it exudes at the user interface as features, but they would not have been actualized without the enabling condition of PIIT, that captures the individual capabilities of direct perception of such features as affording action possibilities. With PIIT, these possibilities for actions were clearly apparent to users who were involved with the technology and it became obvious that individuals had differing views, or direct perceptions, of these affordances. Thus, without claiming exhaustiveness, the four affordances as presented capture the viewpoint of the users, due to the symbolic expressions that were subsumed into the embedded structures of the system (Markus and Silver 2008; Strong et al. 2009), at the time of the data collection.

From the data, PIIT seems to be focused on *initiative to learn, knowledge of the system, and propensity to be creative with the technology*, as a result of learning and not by inherent endowment of the users, or intrinsic aspects of the users' personality (Nambisan et al. 1999). On the issue of taking the initiative to learn the technology, a

user had this to say: *“I do research on my own in order to increase my mastery of the system.”* #U22. With a good knowledge of the system, a user commented: *“I consider myself to be knowledgeable about the new financial website.”*#U23, and for propensity to be creative, another user stated: *“I have learnt the technology and I have also come to discover that no matter how good a technology is, the designers cannot know it all, so I go my own way with their intuitive user interface.”* #U7. These properties, – i.e., *initiative to learn, knowledge of the system, and propensity to be creative* – as suggested by the data, are what the users are endowed with, that puts them in a vantage position to directly perceive the features of the technology as action possibilities. Thus, the actualization of these affordances generates varied emergent usage processes by the actions these users take. Consistent with prior studies (e.g., Seidel et al. 2013; Strong et al. 2009; Volkoff and Strong 2013), the findings confirm that actualization of affordances is in relation to the embedded material of the system, and the capability of the user in a situated context where the technology operates.

9.4.3 Theme 3: Technological Cognizance

Apart from IT affordances, the research data suggest that technological cognizance that captures intense mental modeling or reinterpretation can trigger emergent usage. As experiences of a user could attest:

I didn't quite like the way the categorized spendings were displayed on my tablet. A withdrawal from an ATM shows up as uncategorized money without a clue of what I spent that money for. So I created a new row which I placed as ATM cash withdrawal transaction for every expense. With this, I manually input my ATM withdrawals with each of the items I used that money and display it in a format I can easily remember. Oftentimes if they are much I create a .csv file and upload it into my user model. From there I can pick it up and add it to the ones automatically done by the system and display them on my tablet. (#U9)

This example illustrates a user with a rich mental reinterpretation to support emergent usage. The technology only recognizes online transactions such as ATM withdrawals among others, but cannot infer on what the user spends the money. This prompted the user to create a new row, and tag his purchase transactions to the ATM withdrawals,

manually. Thus, users who customize, adapt, or appropriate actively possess a richer technical cognizance of the technology by reason of its knowledge, making it easier to notice opportunities in novel situations. Besides, the data suggests that most knowledge-minded users value the possibility of using the technology in unanticipated ways, and to develop new task practices around them.

The way I use 22seven to fetch my transactions from different bank accounts and embed them in another different media like my iPad graphics is amazing. I can sync to other devices and export my financial report to either .csv or .pdf in order to print copies of it. <The interviewer further asked. Don't you think it is because of your background as a web-designer? > Yeah, maybe! (#U7)

Even with less 'techie' users, the data suggest that users built mental (re)presentations or cognizance of the technology, to become active appropriators, by tinkering and spending time learning the technology. By this, they were able to overcome the functional fixedness that constrained their insights on novel usage and “allow the possibility of meaningful use to emerge again” (Introna and Whittaker 2003, p. 165). As summarized by a non-techie user:

Being a non-techie is not even a barrier. Acquaintance with 22seven.com is easy although it took some time before I can more or less use it very well. Even, I know which data formats to use in response to different needs. To build a good quality dashboard, I chose the right data formats by fiddling to understand its strengths and weakness. Then I take a choice on the right format that suits my iPad graphics. (#U23)

From the research findings, the researcher can infer that emergent usage of the technology may be constrained in the absence of technological cognizance of users. Such a cognizance captures the deep knowledge of the technology, through mental representations, to become a creative user of technology. The research finding resonates with prior studies (e.g., Nambisan et al. 1999; Salovaara et al. 2011; Tai and Ting 2011) that reveal that technological cognizance fosters the creative or innovative use of technology.

9.4.4 Theme 4: Technology Mediation

The case-study data suggests that the embedded IT agents mediate users' perception towards amplifying some aspects of reality in the e-financial system. Such empirical evidence clearly shows that the scripted IT agents are not merely algorithms; they are complex systems that operate in relation to human operators. Contrary to popular opinion, humans do influence technology operations and the ways it works once implemented, in addition to developing or scripting its being. By this, the agents mediate human actions in such a way that specific actions are favored while others are rejected. This was attested by a user:

Encouraging customers to look at their long-term horizon and save is great for 22seven, but ultimately its investment advisement leads to one place: Old Mutual saving plans, mutual fund, and other products. As it offers savings that link these products, they are likely to get paid whenever a new user opens an account. (#U20)

This statement shows that the technology is amplifying savings plans as a persuasion strategy to invest only. Users, therefore, perceived such persuasions as favoring the organization that made the system available to them. They can sense the technological bias to confirm the fact that IT “. . . artifacts are not neutral intermediaries but actively co-shape people's being in the world: their perceptions and actions, experience, and existence” (Verbeek 2006a, p. 364).

Another user stated:

Financial advisement of 22seven might be technically accurate, but it is difficult for one to uncover the interior motives or conflict of interest that is hidden in the nooks and crannies of the website. (#U27)

Because of the users' perception that the system seems to favor Old Mutual, users are very cautious about its operations; this is manifest as perceived deceptiveness at the empirical domain. The IT personalized agents mediate users' actions by means of scripts

which prescribe how to act when using the artifact and this is skewed towards the organizational interest. As a user could further attest:

I use the technology, but I'm cautious because the technology seems to compel me to believe the financial market as Old Mutual or the technology sees it. This can make me sign-up investments that may not be viable, which they will not even be responsible according to their disclaimer. (#U18)

Thus, the technology is perceived as persuasive, and it constraints the emergent usage of the technology, based on the role the IT mediators act in the technology. Since the access to information is valuable, users considered the mediation agents as filters of alternative products that challenge the users to think differently, or question their initial or earlier investment plans.

9.4.5 Theme 5: Trust-Distrust Dialectics: Bounded Trust

The case-study findings validate the dialectical flux of trust and distrust or bounded trust as the causative agent of the system's emergent usage. Some participants trust the technology because of its brand, yet they are cautious due to its perceived dishonest intent. Some participants are also cautious due to security reasons, while others trust the system's service offerings, despite security concerns. The following quotes illustrate these points:

I somewhat trust the website when I found that Old Mutual recently acquired 22seven which put me at ease, but I sparsely use it. <Why, the researcher asked? >, because I felt that the site might be potentially dishonest having not been tested by the public. (#U19)

Even if I trust 22seven, I'm cautious and afraid when I imagine that their security could be compromised. Um, that can happen, but I don't pray for that. You know, I can't even help it when it does, then my whole banking details are exposed to online fraud, it is really scary. (#U25)

I use 22seven at least once per month to have a total view of my business and savings accounts from different banks. I find this feature extremely important for my personal budgeting. However, when it comes to some investment advisement, I do not trust them. As an investor it might not help me to search for alternatives or for the furtherance of other better investment commitment elsewhere. (#U15)

These data excerpts illustrate that both trust and distrust distinctly coexist and, at the same time, they interact and do not converge in user-system interactions (Komiak and Benbasat 2008; Moody et al. 2014). Findings also amplify the fact that distrust bridles trust, resulting in a bounded trust that places the user in a delicate tension of usage. Within the e-financial system, there are conflicting behaviors of individuals towards the technology. They trust certain features of the system and, at the same time, distrust some other features. This produces a dialectical flux of trust-distrust that seems to influence the system's emergent usage.

The data also reveal that abnormalities and resulting suspicion thrive within the e-financial service-system. Being a disruptive technology, most participants see it as strange and abnormal within the e-financial ecosystem. This supports the fact that the dialectical flux of trust and distrust in the system is seen to be catalyzed by abnormalities and suspicion. The following quotes illustrated these points:

22seven is revolutionary with enticing benefits quite alright. But you see, it is somehow strange and abnormal. It is completely new innovation, and since the banks initially opposed them, we have to exercise caution, wait and see how early users are faring before enlisting. (#U2)

I'm skeptical about 22seven. It is new and has taken a completely different approach to online banking in SA. Although it looks like Internet banking, but has different features and intent that seems not to be favored by some banks in SA, so I'm presently learning how to use it. (#U14)

These data excerpts further suggest that the noticed abnormalities have discomfited users' previous knowledge, attitudes, and behaviors in online banking, thereby compelling them to learn new ways of addressing the technology. Discriminating encoding is evident as users “exercise caution”, adopt “wait and see” attitudes to “see how early users are faring”, while using ‘healthy skepticism’ as a mechanism to understand what motivates others to use the technology, including their possible hidden motives. Some participants emphasized the importance of checking and verifying the system’s functionalities to safeguard them against potential opportunism that could prove to be detrimental to their interests.

I don't take 22seven investment plan on face value. I check and verify everything they said. I asked for the breakdown of the financial product and hidden costs. I have to go out and see for myself whether what they said and are saying is true. (#U27)

While holding on with suspicion, due to the perceived situational abnormality, some participants were indecisive, due to the dialectical flux of trust and distrust.

I suspect fraud intent as my bank hinted, but what is more worrisome is that, that same bank now patronizes 22seven, so I quickly understood that ‘something fishy’ is going on between the banks and 22seven. So I withdrew, still watching how all these things unfold. (#U28)

As the flux skews towards distrust, distrust then assumes a key mechanism for users' self-preservation and isolation from the technology, while they deduce the behavior of other users.

Presently, I tend not to trust the website. Still waiting to see how it unfolds to withstand hackers' prowl. <How? The researcher asked>, I'm waiting for my colleague in the office to tell me more about it. < Does your colleague use the 22seven? the researcher, further inquired> Yes, of course he is the 'guinea-pig' for this technology as far as I know. (#U3)

As the isolation lingers, some participants perceived the vulnerabilities of the technology, which they consider a serious issue, despite its apperceived benefits and the brand name accompanying the technology. A user commented:

Based on my experience, 22seven has put forth some major benefits, no doubt about it. But its vulnerabilities are still serious issues. That's why my colleagues are still delaying signing-on. One of them once told me that I'm being used as a "guinea-pig". But my confidence lies in Old Mutual that owns 22seven. (#U4)

Altogether, the research findings reveal that co-existence of trust and distrust in influencing e-commerce interactions is not linear, as studies would have us believe (e.g., Moody et al. 2014). Trust and distrust not only exist as distinct qualitative entities (Dimoka 2010), but they interact to develop a flux that could be skewed towards distrust or trust, depending on the situational abnormalities, individual apperceptions, or behavioral uncertainty surrounding the technology's situatedness. In this case, at no time has trust functioned without distrust or vice versa; however, it depends on the one with higher powers to influence behavior (Benamati and Serva 2007; Lewicki et al. 1998). They could be in a balance where there are equal powers of trust and distrust to introduce 'trust but verify' or 'healthy skepticism' behaviors in the e-financial context (Benamati and Serva 2007).

9.5 Control Mechanisms

9.5.1 Theme 1 - Critiquing, Reflection, and Learning

This section contains the findings associated with control mechanisms. Critiquing, reflection, and learning are a set of mechanisms that the research data could capture as feedback-based actions. Emergent usage of the technology is a dynamic and on-going process; as users and designers observe usage experiences, they critique, reflect, and learn from them over time. Consequently, the designers adjust the embedded IS structures and the organizational structure, while users adjust their technological cognizance, bounded trust, and the IT affordances. Since the researcher followed the technology in its early days of adoption, the feedback actions merely captured error corrections, as revealed by the data. As SER notion of meta-design theory could attest, at some point the feedback actions shifted from corrections to continuous improvement that captured the system's evolutionary growth while-in-use. The following quotes illustrated these points:

Before now we are busy fixing bugs, but that has waned. Presently we are refactoring some segments of the user library to align with their uses . . . however, any rationale for redesign must be articulated and justified. We can only do this by treating the users' critiques as a springboard to our iterative post-releases. You can no longer feel superior or arrogant when deploying this kind of system – the days of 'build it and they will come' attitude has gone. (#SD3)

Users' experiences as feedback can be reached through our user-collaboration strategy that is inherent in our XP design. Gently exploring and reflecting on why a user might need that feature or functions, we learned from the vital information garnered. We then used the knowledge to rescript our system for better interaction. (#SD2)

Also, the case findings reveal that designers utilize reflection and learning mechanisms to revise the embedded IT structure. Since such structures are not 'holy paradigms', they cannot fully reflect the situated, performative practices at use time. Therefore, the

designers need post-adoption iterations to retrofit the embedded structures, to further adapt to user task accomplishments. Thus, designers engage with users' experiences, reflect on them with other sources of feedback such as usability evaluation, and then re-script the structures. A software designer had this to say:

Yeah. We constantly observe and learn from users' experiences and most time we engage our user group in talks during our evaluation. We found a few . . . issues and that . . . did not match the requirement changes; we go through some iterations to make sure we implement them correctly. Our post-iterations are not to perfectly fit their tasks, but to extend the windows of flexibilities a little more in their user space. These things take IT resources so we don't just generalize it to all users except on rare occasions. We treat each user separately within his/her user space and grow the functions in line with their usage skills in the technology. (#M3)

While the designers were willing and able to revise the embedded structures to capture users' appropriation, the data capture changes within the organizational structure. For example, a designer discovers that ad hoc team formation had increasingly been noticed since the launch of the website, to address user requirement changes.

We have noticed that after the launch of our website, there have been increases in ad hoc team assignment of designers to address users changing needs. Thanks to our management structure that can handle such an arrangement. (#M2)

The data excerpt suggests that significant variation in the way the technology is enacted across contexts (i.e., situational adaptation) has increased, signalling the system's acceptance and appropriation by users. This prompted the assignment of ad hoc teams of designers by the management to confront the random configurations users create as responses to their experiences. This confirms the thesis's earlier assumption that organizational structure swings towards fostering emergent usage of the technology.

Apart from designers, the data point us to the fact that users utilize critiquing, reflection, and learning mechanisms to revise the dialectical flux of trust and distrust towards higher levels of trust. While positive usage experience generates trust, there is a complex relationship between history of user-system interactions and trust, which is constantly in revision. Such a revision depends on users evaluating and reflecting on their past interactions, and on repeated exposures with the system. A user comments:

My experiences with 22seven have made me trust the website more after a series of haggling with my colleagues about its trustworthiness. I came to this point after assessing its functionalities and the Old Mutual reputation behind the brand. (#U3)

Also, in the research data, individual users reported assessing and learning from their experiences, the results of which seem to revise their cognizance of the system. They also sought for better ways of actualizing affordances, as experiences grew. They accumulated more knowledge of the system to creatively exploit the system, as well as adapted their tasks in ways that could fit the features of the system. The following quotes illustrate these points:

Really, I have developed mastering of the website by reflecting on my experiences. To be honest, most of my experiences came from tinkering on it with my iPhone. (#U12)

I have two accounts Nedbank and HSBC. Before now I used to create my dashboard with Nedbank accounts only because of its automatic link with 22seven. Later, I came to understand that I can download my HSBC account statement in .csv format and upload them into my user model. That I did. I then created HSBC account tags and integrate it with Nedbank accounts to populate my user model and from there I built my dashboard that shows my complete accounts. (#U19)

The embedded IT structures, organizational structure, technological cognizance, bounded trust, and the system's affordances are not intended as a complete list of generative mechanisms that were revised or adjusted because of the influence of

critiquing, reflection, and learning mechanisms. Rather, they serve to highlight a few salient changes apparent to both designers and users as far as the data can reveal, at the time of data collection. Emergent usage of the e-financial service-system evolves as users' needs, interests, and preferences change. Thus, as the need for change persists, designers will search for solutions to assist users in repurposing and appropriating the technology.

9.6 Chapter Summary

This chapter revealed the empirical findings that the research provided in regard to understanding the research problem: *“Why does emergent usage occur in adaptive information systems?”* The descriptive insights of the findings emerged from the thematic categorization of case-study research data, which depended very much on the research model through which data was interpreted (Morgan and Smircich 1980; Sarker et al. 2013). Application of the analytical arm of the research model captured the experiential factors that described the emergent usage experiences of users, as answer to research question RQ1, which asked: *“What experiential factors describe emergent usage of adaptive information systems?”* The themes that emerged as experiential factors included: (1) *user empowerment*, (2) *apperception of IS usefulness*, (3) *security and privacy concerns*, (4) *perceived deceptiveness of the system*, and (5) *user satisfaction*. Commensurable with critical realism, these factors dwelt in the actual domain as reflective factors that described the system's emergent usage in the empirical domain.

Similarly, the explanatory arm of the research model held the generative mechanisms retroduced from case-study research data. The generative mechanisms were postulated to explain the system's emergent usage as the answer to research question RQ2, which asked: *“What generative mechanisms must exist for such emergent usage to be possible?”* The generative mechanisms that emerged as themes included: (1) *embeddedness and under-design*, (2) *information asymmetrical structure*, and (3) *organizational structure* as the three enabling structures. The dynamic mechanisms were: (1) *misfits and workarounds*, (2) *system affordances*, (3) *technological*

cognizance, (4) technology mediation, and (5) trust-distrust dialectics, while the enabling causal conditions, especially for system affordances and trust-distrust dialectics, were *(1) personal innovativeness in IT (PIIT) and (2) situational abnormality and suspicion*. Being a system theory, the control mechanisms included a set of mechanisms as: *(1) critiquing, reflections, and learning*.

The identified structures, mechanisms, enabling causal conditions and their interactions summarize a set of patterns that suggest the outcome (emergent usage of adaptive IS). They do not guarantee that such an outcome will occur, but they tend to explain it as corroborated by the empirical evidence, when applied retrospectively to data. Thus, both the explanatory and analytical arms of the research model foster a unified description of the findings, resulting in several novel contributions. One among the key novel contributions is the research model as an emerging mid-range system theory, in answer to research question RQ3, which asked: “*What explains the relations of the mechanisms to effect emergent usage of adaptive information systems?*”

The next chapter presents the concluding model, discussion, and conclusion sections of the research.

Chapter 10

Concluding Model, Discussion, and Conclusion

“... back to the concrete”... interpret the concrete phenomenon from the viewpoint of the theory now developed about it.

(Danermark et al. 2002, pp. 109-110)

10.1 Introduction

This final chapter presents the concluding model of the research, the discussion, and the conclusion of the thesis. Going by the preceding chapter, the generative mechanisms causing the system’s emergent usage and its experiential factors have been identified. Since the model represents an explanatory theory (Gregor 2006), it is used to explain the case under study in the discussion section. The explanation does not take the shape of cause and effect as in the empiricist persuasion (Gregor and Hovorka 2011; Mingers 2006). Rather, a mechanism-based causal explanation is offered from a critical realist perspective (Easton 2010a). Such a causal explanation also takes the shape of theory generalization in critical realism, where the developed theory is generalized back to the case that produces it (Bhaskar 2008b; Tsang 2013). Thus, the observed events (emergent usage of adaptive e-financial systems) are traced back to the structures and mechanisms that make the events happen (Danermark et al. 2002).

The concluding section summarizes the contents of the thesis, identifies the major contributions of the research, and outlines the study’s limitations. It suggests a future research agenda, and brings the thesis to completion.

10.2 Concluding Model and Discussion

By consolidating the research findings, the concluding model of this thesis is proposed and labelled the Technology Emergent Usage Model (TEUM), specifically for adaptive IS (Orlikowski and Iacono 2001), as shown in Figure 31. TEUM also encapsulates the answers to our research questions, wherein the identified structural mechanisms in the model answered RQ2, while the identified experiential factors answered RQ1. The model in its own right provided the answer to RQ3. While being a system model (Burton-Jones et al. 2014), TEUM is the revised version of the research model grounded in the study's data. Thus, the model is said to be the “*explicit interpretation of one's understandings of the situation . . . and a description of entities and the relationships between them*” (Wilson 1984, p. 8). As Figure 17 in Chapter 5 further illustrates, the contextual boundary for TEUM's applicability includes the development and use of the e-financial service-system, the IT artifact itself, and the environments in which the system is developed and used.

To interpret the concrete phenomenon from the viewpoint of the emergent model now developed about it, it is important to acknowledge that the research began from the concrete phenomenon, from where the generative mechanisms were identified as the major findings. Turning back again to the concrete, as specified by Danermark et al. (2002), the derived model is used to explain the situation, starting from the identified generative mechanisms to the events/outcomes. The explanation is also backed up with how the existing literature corroborates with the derived model and how the derived model extends or differs from the adopted theoretical lens (Pan and Tan 2011). This illustrates how to ensure theory-data model alignment (Pan and Tan 2011) that was depicted in Figure 26 of Chapter 8.

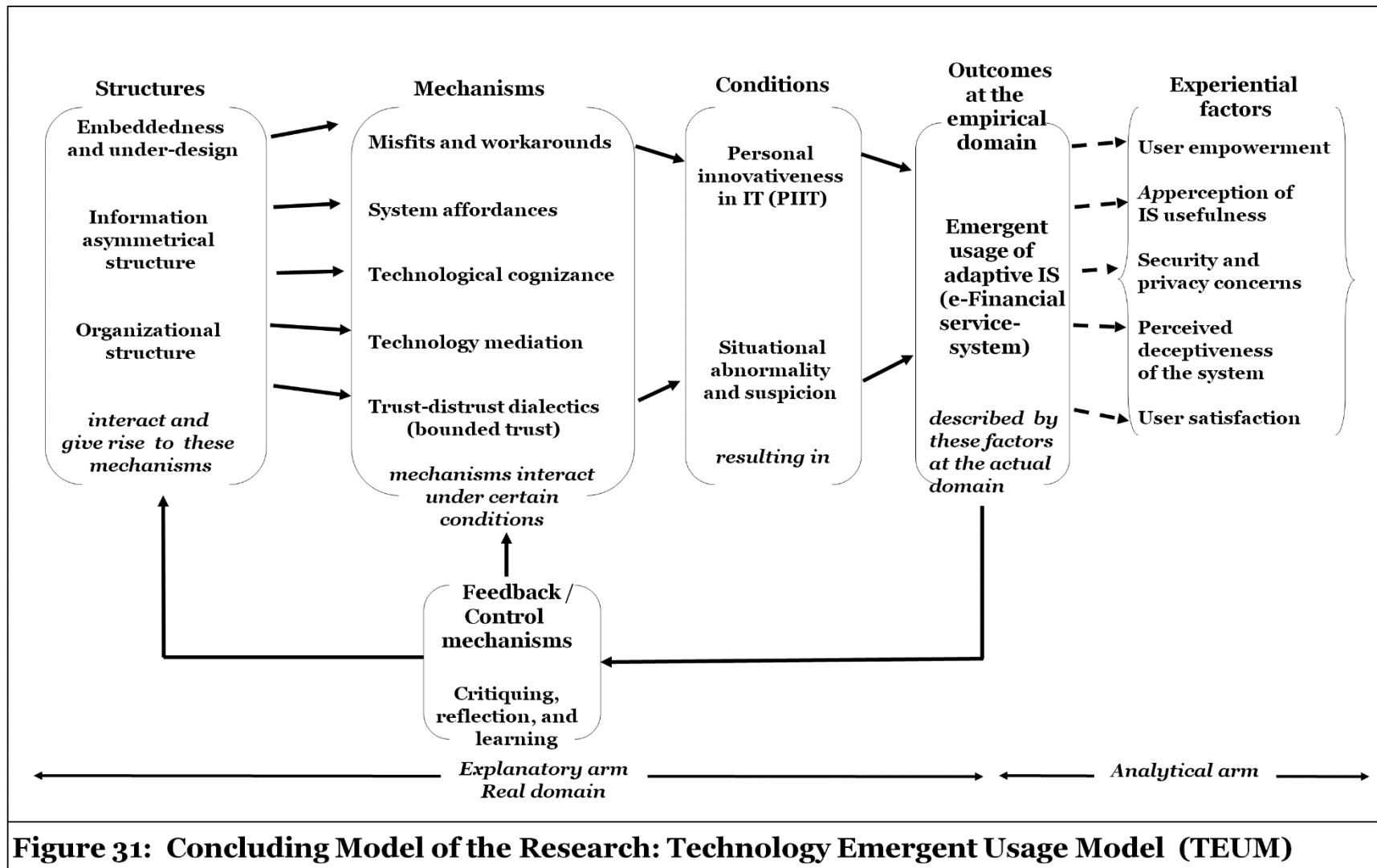


Figure 31: Concluding Model of the Research: Technology Emergent Usage Model (TEUM)

As the TEUM attests, the generative mechanisms are in a state of interactive flux and represent just the first step towards aligning the understanding of individual IS use, when informed by critical realist assumptions. The solid line arrows in Figure 31 capture the HOWs (i.e., the causal relationships between the mechanisms) and WHYs (i.e., the underlying mechanisms that are theorized to explain the causal relationships) of the theory (Suddaby 2010; Whetten 1989). The HOWs and WHYs of a mechanism-based theory are encapsulated in the interaction activities and productive continuity of the causal mechanisms, seen as entities with specific properties (Miller and Tsang 2010). The activities are taken as constitutive of the transformations that yield new outcomes, i.e., causal process or ‘cause and interact’, where an entity acts as a cause when it engages in a productive activity. Therefore, by drawing from analytic dualism (Archer 1995), an ontic description is rendered, in terms of the decomposition of the model into its parts and interactions, as well as the conditions under which they act and are acted upon to produce and reproduce the system’s emergent usage events (Bhaskar 2008b; Smith 2010). By doing that, stage 6 (***i.e., concretization and contextualization***) of Danermark et al.’s (2002) model was addressed, which is also the same as stage 6 of the critical realist data analysis framework in Figure 27 in Chapter 8. This stage 6 involves examining how the identified generative mechanisms manifest themselves in the concrete situation under investigation.

The explanation focuses on the necessity of the non-deterministic causality in terms of laws of working of the generative mechanisms in a fallible manner (Gregor and Hovorka 2011; Mingers 2006). Thus, the explanation is aligned with Sayer’s (2000) view who argues that “[e]xplanation depends instead on identifying causal mechanisms and how they work, and discovered if they have been activated and under what condition” (p. 14). From the concluding model, which also mirrors the research findings, the next section will now discuss how the identified causal mechanisms work and under what conditions, to produce the system’s emergent usage as an outcome.

10.2.1 How the Identified Causal Mechanisms Work in Context

The identified causal mechanisms and the experiential factors, as shown in Figure 31, mirror the WHATs of the developed theory, i.e., concepts that make a substantial contribution to the understanding of the IS phenomenon under investigation (Mueller and Urbach 2013; Suddaby 2010; Whetten 1989). In this section, how the identified causal mechanisms/experiential factors that make up the TEUM are discussed. Such a discussion illustrates the HOWs of the developed theory; the underlying logic or dynamics that justify the interactive activities of the mechanisms; and its causal relationships, to illustrate the WHYs of the developed theory (i.e., TEUM) (Mueller and Urbach 2013; Suddaby 2010; Whetten 1989).

The system's emergent usage is driven by its utility value- outcomes, supported but not necessarily determined by, designers' intent or planned aspects of the technology. However, such usage cannot manifest without designers embedding the real-world e-financial structures, users' interaction routines, security, and privacy compliance into the software artifact (Germonprez et al. 2011; Wand and Weber 1995). While security and privacy compliance define user responsibilities and boundaries, the user-system interaction becomes adaptive and opens the horizon to possibilities for action within the planned aspects of the technology or design procedures (Hovorka and Germonprez 2008).

The embedded software artifact, therefore, possesses a reflective environment, where users' thinking and task accomplishments are supported by the meanings users place on them. Thus, individuals interact and innovate in both known and unforeseen ways within the entire spectrum of the available e-financial services the system offers. Its under-design also provides a space for action in which the user continually adapts such services and creates meaning, as well as develops usage behaviors that align with situated contexts, without the designers' consent (Fischer and Herrmann 2011; Germonprez et al. 2011).

The productive activities of embeddedness and under-design cannot be effective without flexible organizational structures to support them. Also, organizational structures must support user requirement changes, with agile responsiveness (Damaševičius 2010; Lee and Xia 2010), that are associated with embeddedness and under-design structuration activities (Fischer and Herrmann 2011; Volkoff et al. 2007). Consequently, the findings indicate that the effective functioning of the embodied structures depends on the diversified expertise of the designers, their problem-solving skills, and their domain knowledge-base. For these elements to be productive, effective managerial coordination is needed; this is captured by the type of structure the organization holds and its social relations.

Being an e-financial service mediating organization, structures are cultivated that hold fluid routineness to promote collaboration and effective communications. Holding on to fluid routineness is crucial in order to foster both functional and emergent uses of the system, which are often constrained by not only technical issues, but also social processes embedded within the organizational structure (Montealegre et al. 2008). The structure governs and influences the work behavior of designers, their iterative post-releases and user supportiveness. It allows for designer creativity and the pursuit of new IS structures and content-creating possibilities. While doing that, the software functional layer shifts beyond stability to content adaptation over time.

Consequently, user appropriation, workarounds, bricolage, and improvisation or customization to achieve idiosyncratic financial service needs are promoted as the key IS use in this environment. Dependencies of organization structure on software functionalities are seen to enable its emergent usage. This aligns with Conway's (1968) law, which states that any piece of software reflects the organizational structure that produced it. Software structures, therefore, cannot only be described by the technical relationships between units, but also by the social relations between designers, users, and their environment (Hovorka and Germonprez 2011; livari 2007).

Support for the research findings in terms of environmental structures (i.e., social or banking structures) (Fleetwood 2008; Nan 2011), is found in the work of several

scholars (e.g., Al Lily 2013; Dourish 2001). Such work suggests that people's environment can be confronted, shaped, or reinforced by embodying interactions with software artifacts, through individual or organizational considerations. With respect to the case under study, the technology is mainly scripted and deployed for individuals to confront the e-financial asymmetrical structure existing in the South African financial ecosystem. Thus, users perform self-reflection on their use of the technology with respect to the dominant power relation the bank uses, to exploit by reason of the information asymmetries (Hedvicaková and Soukal 2012).

By doing that, users engage with the technology to develop innovative, entrepreneurial ideas to manage such relations (Cohen and Winn 2007). Because of these kinds of user empowerment experiences in the technology, the majority of the local banks in South Africa opposed the operations of the technology, labeling it as deceptive and insecure. However, the behavior of banks did not prevent user adoption of the technology. The users perceived the banks as using security concerns to mask their nervousness about users seeing through the obfuscation that banks place on their account activities. As the TEUM attests, these enabling structures (technical-organizational-environmental) are socio-technically evolutionary, because they interact with human agency to produce mechanisms.

One noticeable mechanism among others produced by these structural interactions is the system misfits and the ease-of-workaround in the system, which foster emergent usage (le Roux 2014). Contrary to the TTF model (Goodhue and Thompson 1995; Shiang-Yen et al. 2012) where system-task fitness is a desirable pursuit, the system misfits are perceived to be healthy within the system environment. The misfits trigger workarounds or tinkering, to create mashups and tag-clouds. There is engagement in service, value re-combination experiences that empower users as creators of value through the widgets placed as icons in their user interface.

Another mechanism that sprouts out of the structural interactions is the system affordances, because of the ambient intuitiveness of the features in the user interface. These affordances present to the user action-making possibilities and meaning-making

opportunities (Markus and Silver 2008; Vatrapu 2010) in a user-system environment bounded by the users' innovative competencies and the system's capabilities. The research findings capture the innovative competence of the user as PIIT, with some elements of cognition that put the user in a vantage position to actualize the affordances, i.e., *service value creation affordances, visualization value affordances, pedagogical affordances, and mobility affordances*. Thus, PIIT assumes the causal condition that activates these affordances, and it also endows users with the ability to actively pick up information exuded by the system's environment, without denial of a few internal/cognitive representations (Vatrapu 2010; Zhang 1997).

To actualize these affordances, users, therefore, engage in various degrees of emergent usage, to cope with the contingencies of the external world and their idiosyncratic financial service needs (Beaudry and Pinsonneault 2005; Dourish 2001). In practice, the actualization of these affordances is done by directly perceiving the system features with little or no interpretation. Thus, emergent usage is driven by the need to address immediate e-financial needs, where there exists little to no time between idea conception and execution. As usage experience builds up due to repeated exposure, weak cognition, that accompanies the system's affordances, gives way to strong cognitive representation in the form of technological cognizance, because of the interactional consequences in the technology. Information, as embodied in the software artifact and individuals are, in interaction, grounded in the situational context-of-use and driven by the users' interpretive flexibility or mental representation.

Users register enough *apperceived* usefulness of the system in their memory, along with the acquired expert knowledge of the system features and their effects. Thus, system affordances and technological cognizance are argued to be two sides of a coin. They are mutually constitutive of each other and both mechanisms are seen to interact with one another in the same system's environment. Technological cognizance is formed, transformed, and reformed via individuals' actualization of affordances and *apperceptions* in the technology. At this point, users can figure out ways to remedy unhealthy misfits or exceptions, and communicate with designers to address underlying causes of such exceptions as feedback (Boudreau and Robey 2005; le Roux 2014).

Instead of having a tendency to fixate users on designers' intent, system affordances interact with technological cognizance to improve users' interpretive/cognitive flexibility (Nambisan et al. 1999; Orlikowski 1992). Accordingly, the more the cognitive flexibility of a user is enriched, the greater the user's ability to match the system misfits with emergent usage. At this point a user can solve problems with the technology, know more about the features of the technology, and re-adapt task routines to fit the working of the technology. Thus, users with heterogeneous expertise in technology use also have more cognitive flexibilities and a greater ability to generate emergent usage.

As user-system interactions continue, perceived deceptiveness is observed. This might be the effects of technology mediation that have biased the system's service offerings towards specific investment opportunities. These investment opportunities are financial services, obtainable from the same organization that has made the system available to users. Thus, the technological mediation acts as a dysfunctional mechanism that attenuates the productive activities of other mechanisms, in generating emergent usage of the technology.

Being a disruptive technology, situational abnormality and suspicion in the system environment trigger the dialectical flux of trust and distrust as causal conditions. When the flux skews towards the trust domain, users actively appropriate the technology, while being apprehensive of security and privacy implications. When in balance they tend to adopt a '*trust but verify*' approach or a '*healthy skepticism*' during emergent interactions. When skewed towards the distrust domain, users adopt isolation and self-preservation (Kupreychenko 2013), while deducing the behavior of others in the technology.

Being a system theory, the feedback arrow signifies that the system's emergent usage is a dynamic process with self-reinforcing mechanisms: critiquing, reflection, and learning. Such self-reinforcing mechanisms occur in one-time usage, to influence future activities of the generative mechanisms and emergent usage behaviors (Hovorka and Germonprez 2013). Thus, future re-use is not driven by intention, as suggested by the research findings, but by e-financial service consumption experiences, or by the

psychological reaction induced by using the system. Such experiences are categorized as experiential factors and are strictly personal and subjective, with utilitarian criteria being manifested in an e-financial system. They are represented as *user empowerment, apperceptions of IS usefulness, security and privacy concerns, perceived deceptiveness, and user satisfaction*.

Characterizing these factors as utilitarian does not exclude them from being spiced with multi-sensorial and affective expressions that arise from their combination, when particularized to the IS innovation in question (Avgerou and McGrath 2005; Orlikowski and Iacono 2001; Venkatesh et al. 2012). The system, therefore, affords innovative characteristics that support utilitarian and emotional consumption experiences. Such consumption experiences take place at the aesthetically enriched user interfaces of smart mobile devices used in accessing the technology. The research findings support the idea that task-oriented technology incorporates hedonic quality as a motivator for capturing its perceived ability to create positive experiences of excitement and enjoyment, while fulfilling task-oriented goals (Hassenzahl et al. 2010).

The dashed arrows in TEUM that emanate from the system's emergent usage to the experiential factors capture the actual events. The arrows also provide the descriptive insights of these factors that constitute the system's emergent usage at the empirical domain, as well as address stage 2 (*i.e., analytical resolution*) of Danermark et al.'s (2002) model. Recognition of such factors takes the analytical arm of the model and is important; however, it is a precursor to the unveiling of the underlying mechanisms. Thus, the research findings are the fruits of the postulation of hypothetical structures and mechanisms, whose reality has now been ascertained through the case-study research method. While *apperceiving* its usefulness, despite security and privacy concerns, users share satisfying usage experiences, which are understood as the emotional consequence of goal-directed technology-use in its context-of-use (Hassenzahl 2004; Scheepers et al. 2006). Thus, satisfaction is tied to actual technology usage in the context-of-use and not on intent, for users will not be satisfied with such a technology unless it achieves the expected task-oriented goals (Hassenzahl 2004).

The fallible mechanism-based causal explanation discussed so far has therefore shown how the developed theory (i.e., TEUM) could explain the phenomenon under investigation or, as Schofield (2002) would say, “*theory of what could be the case*” (p.227). This is also similar to Markus’s (2014) explanatory theory of the problem. Besides, it has generalized the developed theory back to the case that produces it (Tsang 2013). Mechanism-based theoretical explanation of this nature is scarce in the literature (Avgerou 2013; Gregor and Hovorka 2011), despite revealing the fact that non-deterministic causality exists in embedded structures of IS, to shape emergent usage experiences in a particular IS context. While the embodied IS structures are partial solution schemas in response to different time spans of usage, users utilize their experiences to repurpose the technology to fit their idiosyncratic e-financial service needs.

10.2.2 Integration with Existing Knowledge

There are few existing studies regarding adaptive or transformational IS use at the individual or organizational level. It is worth reflecting on how TEUM integrates with this existing knowledge, and how it differs, agrees, extends, and contributes to such existing knowledge. TEUM contributes to existing adaptive IS use research by proposing plausible causal mechanisms which explain emergent usage, which have been unaccounted for by prior theories (Nan 2011). It agrees with Nan’s (2011) emergent/bottom-up IT use model to a large extent, but differs in that Nan’s (2011) model is a descriptive theory. Such a descriptive theory highlights “*the dynamic process where individual-level IT use behaviors and interactions, collaboratively create collective-level IT use patterns and outcomes* (p.505)”. TEUM is an explanatory theory of the problem, according to the typology proposed by Markus (2014), which focuses on individual-level patterns and outcomes. However, since the descriptive theory provides the basic foundation for an explanatory theory (Gregor 2006), it follows that TEUM extends Nan’s (2011) model by providing causal mechanisms.

TEUM also agrees with Burton-Jones and Gallivan (2007), who theorize IS use as capturing deep structural and functional aspects of IS. The difference is in the variance

theorization approach of Burton-Jones and Gallivan (2007), where emergent use is equated to collective behaviors that arise from the habitual nature of individual actions. Instead, TEUM considers emergent IS usage as a process that accounts for planned and emergent duality of use, that arises because of the idiosyncratic user-system interactions that could evoke future interactions, due to positive usage experience (Germonprez et al. 2011; Hovorka and Germonprez 2013; Karapanos 2013; Law and van Schaik 2010; Yoo 2010). Emergent IS use in TEUM is not the aggregated behavior of individuals (Burton-Jones and Gallivan 2007) subject to feedback effects. Rather it is a process that accounts for individual unanticipated behaviors that come to be because of their reciprocal experiential responses that result in attitudinal/behavioral changes to IS use (Hovorka and Germonprez 2013).

TEUM also concurs with the idea of technology adaptation, captured by a range of concepts that are encapsulated in various models. Examples of these models are: the adaptive system use model (Sun 2012), the coping model of usage adaptation (CMUA) (Beaudry and Pinsonneault 2005), the IS use-related activity model (Barki et al. 2007), and the model of technology appropriation (MTA) (Carroll 2004; Fidock and Carroll 2006). Unlike TEUM, whilst these models emphasized technology adaptation at the individual level, their sort of adaptation is driven towards stabilization to achieve task-technology fitness (Barki et al. 2007), routinization (Cooper and Zmud 1990; Orlikowski 1992; Sundaram et al. 2007), or institutionalization (Molla and Licker 2005; Orlikowski 1992), within particular use contexts over time. The use of systems becomes habitual (Limayem and Hirt 2003; Ortiz de Guinea and Markus 2009), shifting from exploration to exploitation (Burton-Jones and Straub 2006). These models also see adaptation as a response to changes in the technology or in the user/the use context and are mostly driven by the original designers and implementers. Unlike TEUM, these models do not accommodate the recursive change in the structures of IS. Such a change occurs due to users' past interactions acting as causal agents to self-reinforce the evolutionary growth of the system while-in-use.

10.3 Conclusion

The conclusion of the thesis starts by first summarizing the contents of the thesis. Thereafter, the thesis contribution, limitations of research, and future research agenda are discussed; this finally bring the thesis to completion.

10.3.1 Summarizing the Thesis Content

The theoretical constructs of IS use raised in this thesis are heterogeneously expansive, when seen in the light of the initial conceptual framework. However, they are unified through the theories of CAS and meta-design, which are endowed with useful terminological heterogeneity for investigating individual IS use. In order to address the research problem, aimed at identifying the causal mechanisms that could generate emergent usage of the technology, participant observations, interviews, document analysis, photography, blogs, and press releases were adopted, while using the research model as a boundary object for data collection and analysis. Besides, emergent usage experiences of the technology are events that have to be analytically resolved to understand the experiential factors that describe them. The conceptual framework synthesized from literature assisted in illuminating the phenomenon for empirically identifying such factors. The analytical arm of the research model provided the descriptions of the dimensions and properties of the system's emergent usage, that manifested themselves in the empirical domain. Following Bhaskar's (2008b) suggestion that scientific research should not stop at recognizing the events that may or may not be observable in the empirical domain, the research moves beyond the analytical impasse of most IS use studies, to exhume the underlying mechanisms. To do that, the six stages of Danermark et al.'s (2002) model were adopted, which offer a very useful philosophically-oriented model for conducting critical realist IS research (Dobson et al. 2013; Radulescu and Vessey 2009). As advised by Dobson et al. (2013) and also from experience, the research did not strictly follow the six stages of Danermark et al.'s (2002) model chronologically in an iterative process. Rather, the stages were dispersed across most chapters of the thesis wherein some of the stages overlapped.

Chapter 1 began by introducing the research problem that culminated in the proposed research questions. It progressed to discuss the research goals, the investigative context of the research, background, and motivation for the research. It introduced the research design and provided an outline of the thesis structure.

Chapter 2 grounded the thesis in critical realism, from which the knowledge proffered in the subsequent chapters of the thesis were defined. By elaborating on critical realist assumptions, this chapter provided the researcher's *ontological, epistemological, and methodological premises* that guided decisions about the direction of the thesis.

Armed with critical realist assumptions from Chapter 2, a critical realist literature review for theory development was presented in **Chapter 3**. Prior studies pertaining to IS design and social shaping of technology, end-user development, bricolage, workarounds, improvisation, appropriation, adaptation, customization, and tailoring were reviewed, to abstract causal mechanisms that could generate emergent usage of IS. Besides, literature related to emergent UX in IS, especially from the HCI field, was reviewed, to abstract experiential factors. Such factors could describe the system's emergent usage, which were considered as an experience users undergo, by reason of the actual usage. Thus, a future research agenda was derived. This was based on the knowledge gaps identified from the synthesized literature and re-visitation of the research questions to focus the research. The three-tier ontological dimensions of critical realism – *the real, the actual, and the empirical* – were drawn upon, to put the causal mechanisms and factors in relation to one another, in order to build the critical realist conceptual framework.

Chapter 4 introduced what theory or theories should be in critical realism parlance. It also introduced the extant theories of CAS and meta-design, from whence their explanatory powers were ascertained in explaining the system's emergent usage. An immanent critique of other competing theories was rendered, to show why they were not considered in this research. By this, stage 5 (*i.e., comparison of theories and abstractions*) of Danermark et al.'s (2002) model was addressed, to confirm the fact that there were rational grounds for preferring one theory over another.

Chapter 5 discussed the overall case-study research design. It also discussed the exploratory case-study design and its preliminary multiple data collection strategy as Phase 1 of the research design. Such research design was used to explore, discover, and describe events, activities, forces, and contexts that shape the system's emergent usage. Phase 1 of the research designs orientated the researcher towards discovery, description, and analysis of the context, to understand the phenomenon.

Chapter 6 introduced the findings from the exploratory case-study conducted in Chapter 5, as the preliminary evidence. The preliminary evidence was presented in the form of the research context, the case description, and analysis that assisted the researcher to understand the phenomenon. Thus, stage 1 (*i.e., description*) of Danermark et al.'s (2002) model, was addressed, which stipulates that events under study need to be explicated. Also, by understanding the research context, extant theories of CAS and meta-design were conjectured as what could explain the IS phenomenon under investigation.

In **Chapter 7**, the **research model** was developed through the theoretical redescription process as one among the notable theoretical contributions of this research. This demonstrated the overlap of stages 3 (*i.e., abduction and theoretical redescription*) and 4 (*i.e., retroduction*) of Danermark et al.'s (2002) model. There was an abductive matching showing the congruence between the conceptual framework, theories of CAS and meta-design, and the preliminary empirical evidence. With this, the IS phenomenon under investigation was redescribed, in order to abstract the causal mechanisms as a form of particularizing the theories into the investigative context. The abstracted mechanisms were then postulated as the probable cause of the system's emergent usage, via the retroductive process. The experiential factors were also hypothesized as what characterized emergent usage of the technology, by drawing from the conceptual framework.

Chapter 8 presented the explanatory case-study research design that was used for empirical corroboration of data with the research model, as the Phase 2 of the research design. Such an explanatory case-study is biased towards the critical realist retroductive

approach, in order to address stage 4 of Danermark et al.'s (2002) model. The structured participant observation and the critical realist interview techniques, used in collecting additional data, were outlined. The two types of thematic data coding and analysis – semantic and retroductive latent-based coding – used in the analysis of the data were also outlined in this chapter. A critical realist thematic data analysis framework was formulated and used as a guide for analyzing the data as one of the contributions of the research.

Chapter 9 discussed the findings that were two-fold. Firstly was the identification of the experiential factors that characterized the system's emergent usage, using the analytical arm of the research model. The identified experiential factors described the emergent usage of the technology as the answer to RQ1, and also addressed stage 2 (*i.e., analytical resolution*) of Danermark et al.'s (2002) model. The analytical resolution was evident when the phenomenon under investigation was analytically resolved into a number of empirically identifiable components, in the form of the experiential factors. Secondly was the identification of the structures and mechanisms using the explanatory arm of the research model as the answer to RQ2. The identification of the causal mechanisms also addressed stage 5 (*i.e., comparison of theories and abstractions*) of Danermark et al.'s (2002) model, by eliminating extraneous mechanisms from the findings. The elimination process was carried out by comparing the research model with the data, abstracting the mechanisms that corroborated with the data, and ignoring the spurious/non-plausible ones.

Chapter 10 discussed the concluding model (*i.e., TEUM*) of the research as the answer to RQ3, as well as the discussion and conclusion of the thesis. The discussion served to re-contextualize the concrete (*i.e., system emergent usage*), by using the identified structural mechanisms and factors to explain the phenomenon. The discourse on the TEUM addressed stage 6 (*i.e., concretization and contextualization*) of Danermark et al.'s (2002) model. It re-situated the illuminated necessary mechanisms and the experiential factors into the context, transforming the researcher's view of the phenomenon under study into what could probably have caused the phenomenon to happen. Within the conclusion section, the research contributions – *theoretical*,

methodological, and practice – are also discussed as well as the research limitations, further research, and the chapter summary which brings the thesis to a close.

10.4 Research Contributions

Addressing the research problem resulted in three types of contributions – *theoretical, methodological, and practice*.

10.4.1 Theoretical Contributions

The concluding model of this research (*i.e.*, **TEUM**) that took the shape of a system theory is novel and, therefore, constitutes the major theoretical contribution of this thesis. Such a model distinguishes itself as original and useful among theories that relate to structural and agential properties of IS use and how they interact. It provides researchers with more precise mechanism-based constructs for hypothesizing and explaining the causal pathways in emergent IS use processes. While grand theories such as structuration theory, morphogenetic theory, and CAS theory can be adapted to examine structure-agency properties of IS, they are highly abstract in nature and fundamentally non-propositional (Jones and Karsten 2008; Mutch 2013; Nan 2011). Thus, **TEUM** stands out as a theoretical contribution having been adapted from a grand theory to serve as a mid-range system theory. TEUM promotes the in-deterministic view of emergent IS use, while supporting the explanatory and empirical exploration of definite mechanism propositions in a specific IS context. Several IS scholars (e.g., Avgerou 2013; Burton-Jones et al. 2014; Gregor and Hovorka 2011; Markus 2014; Straub and del Giudice 2012) have argued for the need for such a theory to explain the complexity of use of the new-breed adaptive IS, having noticed a paucity of explanation in prior studies. By formulating assumptions around structures, human agencies, the environment, and their interactions over time, TEUM model can provide a precise specification of expansive mechanisms, central to emergent usage of IS in its situated context.

TEUM's organic linkage of micro-level action and macro-level institutional/societal processes is also very useful for theorizing the impact of organizational and socio-economic structures on individual IS use, leading to subsequent updates of such structures. IS scholars (e.g., Jones and Karsten 2008; Nan 2011; Volkoff and Strong 2013) have argued for the usefulness of such a theory that could accommodate the micro and macro-institutional/socio-economic perspectives into a socio-technical theoretical framework. Researchers can, therefore, theorize and have an understanding of technology as being but one component in a web of socio-economic activities.

The activities of the mechanisms and the experiential factors that were captured by TEUM have novel insights for understanding IS use in their own right at the individual level. For instance, system misfits are perceived to be healthy in enhancing the emergent IS use, in contrast to TTF assumptions. Trust and distrust are seen as distinct by some scholars (e.g., Dimoka 2010; Moody et al. 2014), but few studies have acknowledged their state of dialectical flux that could influence IS use in a non-linear manner.

The nature of the experiential factors of the model have buttressed the fact that task-oriented technology incorporates hedonic quality as a motivator for capturing its perceived ability to create positive experiences, while fulfilling task-oriented goals (Hassenzahl et al. 2010). Also, the characteristics of the experiential factors in the model, although being utilitarian, are seen to be embedded with hedonic qualities, to confirm the duality of rationality and emotionality in IS innovation (Avgerou and McGrath 2005; Hassenzahl 2003). Spotting the characteristics of these factors is considered as novel, because prior studies (e.g., Venkatesh et al. 2012) have considered rational and emotional elements in IS innovation as distinct and linear in influencing individual IS use. Apperceived usefulness of IS is a new construct introduced into individual IS adoption vocabulary by this thesis. Unlike TAM (Davis et al. 1989), apperceived usefulness is a re-conceptualized view of IS usefulness that incorporates contextual adaptation, and rational and emotional aspects, driven by more of the mental content of past experiences of technology-use, relative to its context-of-use.

Other theoretical contributions of the thesis are: (1) the conceptual framework synthesized from the literature, and (2) the abductive pattern-matching approach to theory development, further illustrated in a concise manner in Figure 25. The conceptual framework is a definitive meta-model that synthesizes what is known; it could provide a foundation to guide the future critical realist IS researches in this area. This conceptual framework originated from a critical realist literature review, which is also considered as contributing to the literature. Such a review integrates both interpretivist and positivist assumptions of prior studies, to bring new insights into expansive key mechanisms and their interaction. Recently, scholars (e.g., Okoli 2012; Rousseau et al. 2008; Rowe 2014) have argued in favor of such literature review for explanatory theory development.

Altogether there is valuable potential for critical realism's three-dimensional stratification, namely, *real-actual-empirical*, to provide theoretical contribution in IS research. Such a stratification of social reality, when applied to IS innovation, helps in the search for underlying mechanisms that could cause IS phenomenon, rather than being trapped on the surface events. Besides, it helps researchers to build better mid-range theory specific to a technology type, while still allowing the intrinsic characteristics of such technology in relation to the social elements theorized in a non-deterministic manner.

10.4.2 Methodological Contribution

The methodological contribution of this thesis is three-fold. Firstly, the research provided an exemplar empirical case-study underpinned by critical realism. Empirical work in critical realism, dubbed as philosophy in search of a method (Yeung 1997), is still very scarce (Henfridsson and Bygstad 2013; Vega and Brown 2011). This research therefore provided a valuable contribution and can be a reference source for future research. Particularly, the application of Danermark et al.'s (2002) model is possibly the first to have faithfully adopted the six stages in empirical IS research. Danermark et al.'s (2002) model, rather than the methodological principles offered by Wynn and Williams (2012), was chosen to support the conduct of the critical realist case-study research.

Wynn and Williams' (2012) principles are implicit or mute on some core assumptions of critical realism's explanatory framework, as suggested by some scholars (e.g., Bhaskar 2008a; Danermark et al. 2002). Ideas related to the concretization and contextualization stage were muted, while theoretical redescription was implicitly stated in Wynn and Williams' (2012) principles.

Secondly, the contextually-rich longitudinal case-study design used in this thesis contributes to IS research methodology. It highlights the issues related to emergent usage of the e-financial system, while taking into account the dynamic interactions between process, people, and technology. Consequently, there was integration around the IT artifact perspective, by interviewing people about their experiences when the technology was applied to “. . . *support some task(s) embedded within a structure(s) that itself is embedded within a context(s)*” (Benbasat and Zmud 2003, p. 186). As such, the research participants spanned across users, designers, and the management, i.e., people who were involved in the conception and deployment of the adaptive e-financial system. This kind of approach enabled thorough understanding of the case, and also revealed hidden cues for retroductive theory development, while bringing the object of study closer to the surface, for easier detection of the underlying mechanisms.

Thirdly, the critical realist qualitative data analysis framework, presented in Figure 27, is considered as the first of its kind in the IS field, having adapted it from the works of Crinson (2001, 2007), by including the theoretical redescription stage as theoretical data (Danermark et al. 2002; Layder 1998). While acknowledging that participant's interpretative understanding is crucial, the critical realist qualitative data analysis framework of this thesis takes it further, by bringing in the theoretical redescription as data, while conducting the retroductive data analysis. Consequently, the hidden structural contexts and the non-discursive referents and their relations were identified in the data, when coding and categorizing the themes, using the theoretical redescription as a template (Iosifides 2011; Layder 1998). Thus, theoretical redescription was used to stimulate theoretical insights, for conveying the latent meanings, from the empirical data.

10.4.3 Practical Contribution

The research offered significant practical contributions in three ways. Firstly, since the technology is designed for embodiment, emergent use, and evolution while-in-use, managers/software designers can utilize the identified mechanisms as effective strategies for intervention. In particular, the research indicates that managers need to focus on cultivating a strong climate for enriching the functional mechanisms, while minimizing the interactive effects of the dysfunctional one(s). The understanding of the impact of critiquing, reflection, and learning as feedback mechanisms could assist in developing change management plans and evolutionary trends of the technology. By adopting these intervention strategies, organization could extract more business value from the IS innovation, while making incremental post-releases, that could drive effective IS functionality.

Secondly, as surreptitious post-releases and users' appropriation continued, the research findings could inform managers that fluid organization structure should be strengthened, by long-term commitment and support from the management, to handle recurrent exceptions. Upskilling of the designers should be paramount for effective system functioning, which largely depends on designers' expertise and responsiveness to support user requirement changes.

Thirdly, the research revealed the importance of the case organization to start putting owners of problems (end-users) in charge, since they were no longer passive, but evolvable and unwitting secondary designers. Although not experts in software development, or aiming to be so, users engage with the system adaptively for daily e-financial task activities. Such users want easily accessible systems which can afford them the chance to customize their needs in their contexts-of-use. As they do that, the system, being adaptive and evolvable, implicitly affords them more structures to confront such exploitation and, as such, users unknowingly become designers.

10.5 Limitations and Future Research

Key limitations of this research stem from critical realist assumptions and the extant theories' limitations used in this thesis. Being a fallible philosophy (Sayer 1992), there is no claim that the identified generative mechanisms fully explain the emergent usage of the e-financial system. Also, since "*we are prisoners in the cave of our theories*" (Bhaskar 2008b, p. xii), not all of the generative mechanisms relevant to what was observed were discovered. Dysfunctional mechanisms are less frequent in TEUM and, also, those mechanisms related to user-coping strategies of adaptation to IS. Future research could, therefore, apply coping theory (Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984), or any other theory congruent with critical realism, to exhume such mechanisms in the same IT artifact. Also, TEUM did not properly capture the specificity associated with the socio-cultural settings of South Africa, and its effect in the emergent usage of the e-financial service-system under study. This can be explained by the empirical situatedness of the research that skewed towards the western-oriented population of South Africa. Their socio-cultural settings mimic the western world and they drive the formal economy of South Africa. Such people formed the bulk of the knowledge workers interviewed; they are also socio-economically and intellectually empowered to use the technology.

To increase the utility of the model (TEUM), with the aim of further refining or ascertaining the generalizability of the model, other types of adaptive IS could also be used in future research; this could focus on other socio-cultural settings in South Africa. The TEUM can provide a new way to explain emergent usage of adaptive IS. Consequently, it is useful for studies investigating deep structures of IS and in contexts in which this kind of behavior occurs. TEUM is a useful tool for asking how and why questions, about how systems come to be used in certain novel ways and what must exist for such usage to be possible. However, TEUM is less effective when focused on measuring the extent of emergent use, especially when such emergent IS use is theorized as a collective behavior (Burton-Jones and Gallivan 2007). In that case, the model for measuring emergent "*system usage as the aggregation of individual*

behaviors”, proposed by Burton-Jones and Gallivan (2007, p. 659), may be more appropriate.

Only two contextual conditions of two mechanisms were identified in TEUM, i.e., the dialectics of trust-distrust mechanism and system affordances; thus, future research can build on the model to exhume other contextual conditions. For instance, IS researchers need to know the contextual condition(s) under which technological cognizance operate(s), or if it needs any complementary mechanism(s) to function fully and, if it does, what is in the nature of the mechanism in terms of its effect size or power. To do this, a regression spline function analysis, based on quantitative data, can be utilized in future research. Particularly, the multivariate adaptive regression splines (MARS) can be used to evaluate and explain the causal links existing between identified mechanisms (Kositanurit et al. 2006; Miller and Tsang 2010). MARS analysis, using an extensive critical realist research design and retrodictive analysis, (i.e., using the identified mechanisms to explain new outcomes), can expose mechanisms that are working in concert with others, can measure mechanism effect sizes as coefficients and the mediating effects of the countervailing contextual mechanisms or conditions (Miller and Tsang 2010; Osei-Bryson et al. 2008).

Whilst being cautious about drawing conclusions about the experiential factors as what could describe the emergent usage experience, factor analysis could be used to confirm that such factors were all capturing the emergent usage of IS. Although the interview approach of this thesis gave cues to unveil the users' underlying reasons for emergent IS use, the data were collected after the fact. Thus, the data validity might be questionable, due to the retrospective generalizations, based on false memories. However, the critical realist interview and participant observation data triangulated against the interview data during analysis, lessen the effect of such retrospective generalizations.

10.6 Chapter Summary

This chapter concludes the Ph.D. thesis titled: **MECHANISMS FOR EMERGENT USAGE OF ADAPTIVE INFORMATION SYSTEMS: A CRITICAL REALIST CASE OF e-FINANCIAL SYSTEMS IN SOUTH AFRICA**. It summarized the probable generative mechanisms that could generate emergent usage of adaptive e-financial systems and the experiential factors that could describe such usage. Holding on to TEUM as the main theoretical contribution of the thesis, provides compelling and fascinating insights into how causal mechanisms, related to the intrinsic characteristics of an IT artifact, and how its social elements, all interact to produce what was observed. What was observed (i.e., emergent usage of IS) then has its experiential components. Such components are non-causal, but provide symptomatic cues as to what might have caused them to happen. Other theoretical contributions exist, as well as the methodological and practical contributions, to showcase the originality and novelty of this research, within the critical realism paradigm. Limitations of the research are noted, wherein future research ideas to address such limitations have also been proffered.

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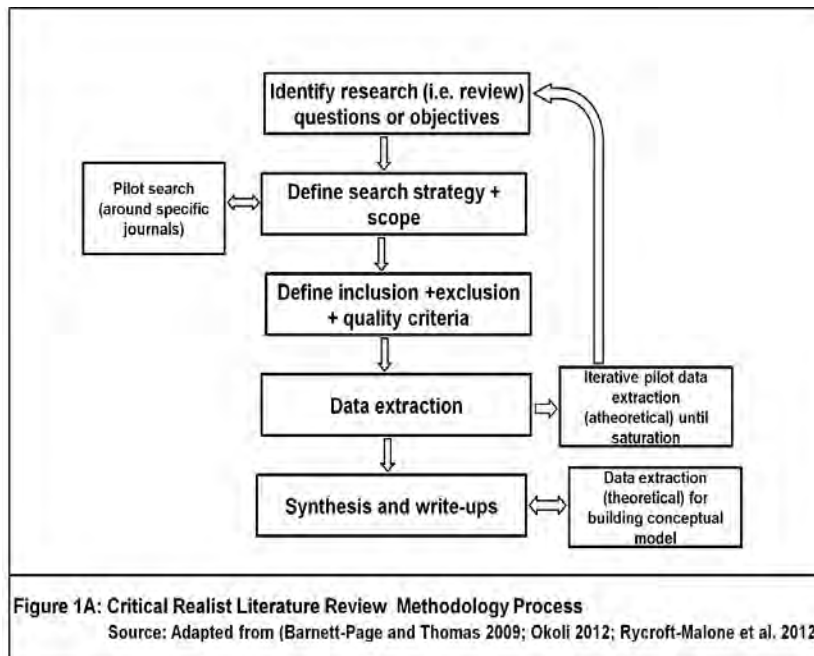
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Appendix A

Systematic Literature Review Methodology

Following Rowe (2014), a systematic literature review is defined as: “a form of secondary study that uses a well-defined methodology to identify, analyze and interpret all available evidence related to a specific research question in a way that is unbiased and (to a degree) repeatable” (p. 246). By adopting this definition as a working definition leads to the development of a conceptual framework. The model will then act as a starting point for further research agenda (Okoli 2012; Rowe 2014; Schryen 2013).

A guideline in Figure 1A depicts the systematic review methodology for theory development of this thesis. Thus, the next section will start with the identification of the review question/objective.



Purpose of Literature Review

The purpose of this literature review is to synthesize relevant literature of emergent usage of IS from multiple disciplines. The literature review is aimed at unveiling the causal mechanisms for emergent usage of IS and the factors that describe such usage experience. By carrying out the review, a critical realist conceptual framework was developed. Such a model acted as a starting point for proposing the research agenda for the topic under investigation (Rowe 2014; Schryen 2013).

Search of the Literature

A comprehensive literature search was conducted, using several indexed sources. Before proceeding to use major databases, an improvised literature search around specific journals was first adopted, to define the scope of the review. However, it was discovered to be a cumbersome process, constraining a wider scoping of literature. Consequently, the earlier improvised literature search was abandoned to engage Google scholar and other major databases such as Emerald, Business Source Complete (EBSCO), Science Direct by Elsevier, ProQuest LLC, Springer, Scopus, Wiley and Metapress.

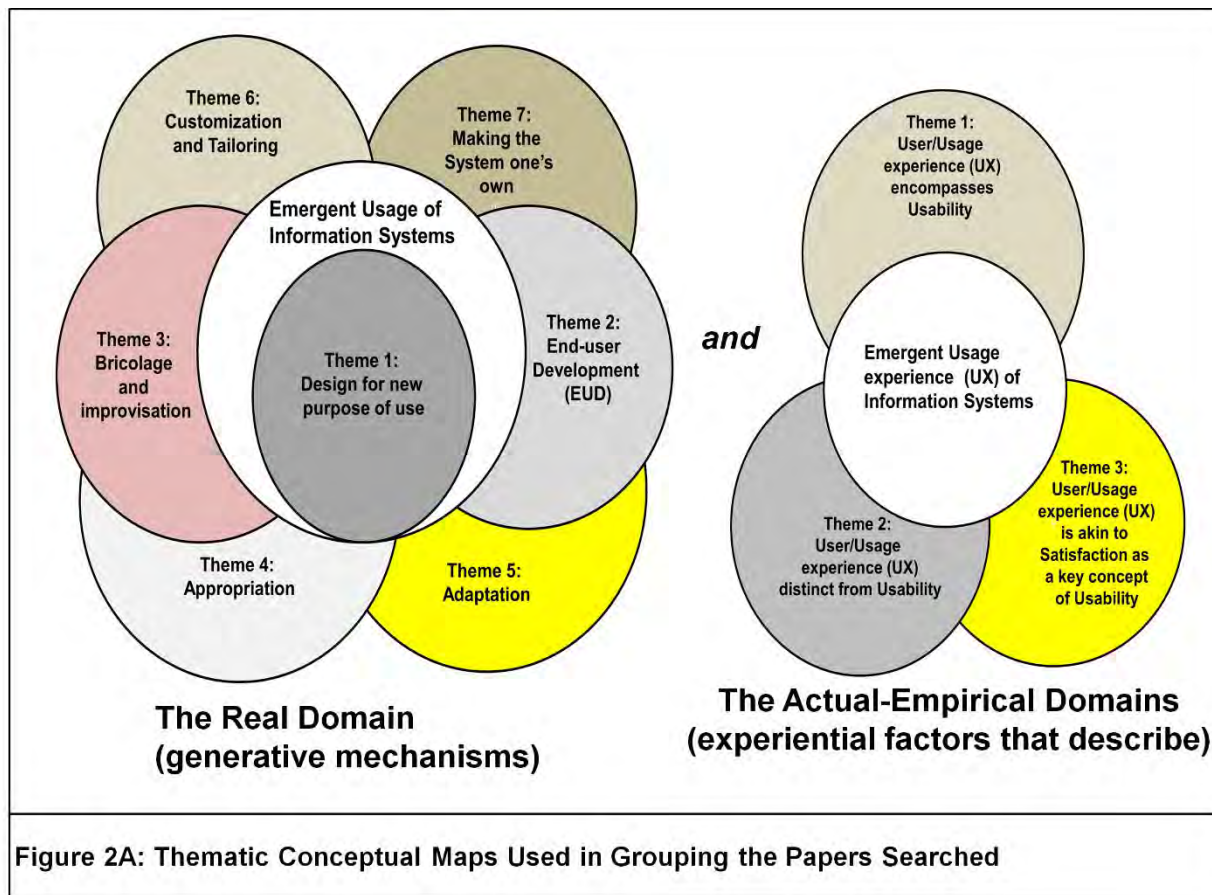
To bring in highly-rated information systems (IS) and human-computer interaction (HCI) conference proceedings, AIS Electronic Library (AISE), CHI, IEEE Xplore and ACM Digital Library were also searched. The broad search captured the interdisciplinary nature of the phenomenon which implied relying on a very wide range of sources from several disciplines as recommended by IS scholars (e.g., Okoli 2012; Rowe 2014). Particularly, the multi-disciplinary search of literature is highly favored in critical realism because different interacting mechanisms that generate the phenomenon under study can be constitutive elements of different disciplines (Okoli 2012; Vega and Brown 2011).

The following keywords were used for the automatic search:

- “Information technology” OR “information systems” AND “adaptation”

- “Information technology” OR “information systems” OR “software” AND “end-user development”
- “Information technology” OR “information systems” OR “software” AND “variability design” OR “flexible design”
- “Information technology” OR “information systems” AND “secondary design” OR “design in use”
- “Information technology” OR “information systems” AND “appropriation”
- “Mobile technology” OR “media communication” AND “appropriation”
- “Information technology” OR “information systems” AND “bricolage” OR “improvisation” OR “work around”
- “Information technology” OR “information systems” AND “customization” OR “tailoring”
- “Information technology” OR “information systems” AND “personalization”
- “Information technology” OR “information systems” AND “domestication”
- “Information technology” OR “information systems” AND “deferred theory”
- “Information technology” OR “information systems” AND “social shaping theory”
- “Information technology” OR “information systems” AND “activity theory”
- “Information technology” OR “information systems” AND “complex adaptive system theory”
- “Information technology” OR “information systems” OR “software” AND “meta-design theory”
- “Information technology” OR “information systems” AND “intended and unintended consequences”
- “Information technology” OR “information systems” AND “creative use” OR “adaptive use”
- “Information technology” OR “information systems” AND “innovative use” OR “emergent use”
- “Information technology” OR “information systems” AND “transformative use” OR “unanticipated use”
- “Information technology” OR “information systems” AND “trying to innovate” OR “feature extension”
- “Information technology” OR “information systems” OR “software” AND “user experience (UX)” OR “experiential use”
- “Information technology” OR “information systems” AND “emotion” OR “hedonic attributes”

Initial exclusion was done to expunge studies not directly related to our review objective, with the inclusion of any study type, for example empirical, theoretical, conceptual, quantitative and qualitative papers. Papers were then grouped on the basis of their content using the thematic conceptual maps as shown in Figure 2A.



The reference lists (i.e., backward citations) of articles that have thus far been included in the review were searched. This further identified a handful of papers that escaped the net of the automatic search. Forward citation search was carried out to identify the most recent articles that had not been indexed. Using the backward and forward citations, relevant articles published as book sections as well as one doctoral thesis that was highly relevant were found. The books were located in UCT library or via the e-books read only assistance from the library, while the doctoral thesis was trapped by Google scholar.

Inclusion, Exclusion and Quality Criteria

Inclusion, exclusion and quality criteria helped in identifying studies that addressed the review objective, which also mirrored the research questions. The questions below were

utilized to sieve-out some papers, after scanning each paper to establish its appropriateness. Any paper, (i.e., empirical, conceptual, and theoretical) that did not answer YES or partially YES to these quality appraisal questions were excluded. Some waivers were given to conceptual and literature-based papers that were found to be highly relevant to our study. These questions were adapted from scholars (e.g., Mahdavi-Hezavehi et al. 2013; Okoli 2012).

Questions

- Q1 Is there a rationale provided for why the study was undertaken?
- Q2 Is there an adequate description of the context in which the research was carried out?
- Q3 Are there justifications and descriptions of the research design?
- Q4 Is there a clear statement of findings, including data that supports findings?
- Q5 Is there a precise definition of concepts?
- Q6 Is there a precise specification of the relationship between the concepts?
- Q7 Are there specifications of concepts moderating the relationships between the concepts? If not can the researcher easily infer the moderator(s)?
- Q8 Are there theory/theories that the paper used to drive the identification of the concepts?

Further quality appraisal, such as how much importance to give each paper and the degree of confidence that could be placed in theoretically proposed relationships were not carried out. Scoring of the methodological quality of the papers, were not also carried out. These activities were not carried out because it is not necessary for a critical realist literature review that aimed at theory development (Okoli 2012).

From the nearly 1 200 references, 300 were selected for further review, based on these criteria (i.e., Q1-Q8). All the 300 references were reviewed, based on their titles and abstracts. They were later assigned to one or more of the seven categories for the generative mechanisms, and to the three categories for the experiential factors, as shown in Figure 2.

Data Extraction

The selected primary studies were read in detail to extract the data needed, in the light of the review objective (Rowe 2014). From each group, a paper was picked and thoroughly read to extract concepts and relationships, contexts, and theoretical explanations for the existence of the relationship between the concepts (Okoli 2012; Rycroft-Malone et al. 2012). From the theoretical explanations, the reason for the relationship between concepts was inferred and a label (i.e., concept) was adopted that captured such reason(s) (Okoli 2012; Rycroft-Malone et al. 2012). The underlying structural mechanisms that bring about such relationships were also inferred and traced to their associated events (Okoli 2012; Rycroft-Malone et al. 2012). To infer and identify the causal mechanisms is the first (low-level) thematic coding carried out and is *atheoretically* done (Barnett-Page and Thomas 2009; Mahdavi-Hezavehi et al. 2013). The themes, or rather the concepts, gathered at this stage were the materials used for the synthesis and writing-up of the literature review in a concept-centric manner (Barnett-Page and Thomas 2009; Webster and Watson 2002). The write-up was interspersed with landscaping to increase understanding and to reduce de-contextualization (Barnett-Page and Thomas 2009; Rowe 2014; Webster and Watson 2002). A further search of literature was also done at this stage, but only marginal improvements were observed in achieving the review objective, suggesting saturation, and so the researcher had to stop.

While there was no formal criteria to establish saturation, one obvious indicator was that additional papers discovered, read, and from which data were extracted, introduced familiar theoretical explanations and concepts, though with different labels, in some cases (Boell and Cecez-Kecmanovic 2014). Besides, the researcher stopped because of his pragmatic judgment of the exhaustiveness of the review for this particular purpose. Such an exhaustiveness is guaranteed by looking at cited publications of the most recent papers, where there was nothing new or novel found (Boell and Cecez-Kecmanovic 2014).

Synthesis and Write-Up

As stated earlier, the concept-centric or the thematic approach was used to synthesize the literature and writing it up (Barnett-Page and Thomas 2009; Okoli 2012; Webster and Watson 2002). After the synthesis, another extraction of data, based on critical realist assumptions was carried out, by thoroughly reading the synthesized write-up to offer interpretations of the concepts and their relationship (Barnett-Page and Thomas 2009; Rycroft-Malone et al. 2012). By doing this, the key concepts as generative mechanisms for the real domain were inferred, identified and placed in Table 1A. Likewise, the key concepts as experiential non-causal factors for the actual-empirical domains were inferred, identified from synthesized and also placed in Table 2A. Note that Table 1A here is the same as Table 6 in the main thesis, while Table 2A is the same as Table 7 in the thesis.

Table 1A: Overview of Literature Review and Critical Realism Implication in Abstracting Generative Mechanisms from the Synthesized Literature				
Proposed Typology	The Literature Synthesized			Critical Realism Implication (Real Domain)
Perspectives of thought	References	Theory/Theories Used	Level of Analysis	Concepts as Structures and Mechanisms Inferred from the Synthesized Literature
Design for new purpose of use	(Dix 2007; Dourish 1999, 2003; Fischer and Herrmann 2011; Hanseth and Lyytinen 2010; Heeks 2002; Pahlke et al. 2010; Patel 2012; Patel et al. 2010; Patel and Hackney 2010; Perry and Rachovides 2007; Pipek and Wulf 2009; Sengers and Gaver 2006; Tiwana et al. 2010; Wakkary and Maestri 2008; Wulf et al. 2008)	CAS theory, Theory of deferred action	Organizational	Versatility, reflexivity, flexible IS architecture, modularity, incremental adjustments, user community, visibility of users, persistence, playfulness and exploration, ambiguity into purpose of use, simplicity-in-design, adaptation, and deferred action
End-user development (EDU)	(Ahmadi et al. 2008; Amoroso 1988; Amoroso and Cheney 1992; Asand and Mørch 2006; Barker 2007; Brancheau and Brown 1993; Burnett and Scaffidi 2014; Fischer 2010a; Fischer and Giaccardi 2006; Fischer et al. 2004b; Fischer and Herrmann 2011; Giaccardi and Fischer 2008; Ko et al. 2011; Lieberman et al. 2006; Paternò 2013; Shayo et al. 2002; Zmud 1984)	Meta-design theory	Organizational	Underdesign, user motivation of being empowered, flexibility, local control of job environment, communicative empowerment of users, training-support, and endowed expertise
Bricolage and improvisation	(Alter 2014; Arora et al. 2010; Boudreau and Robey 2005; Ciborra 1992, 1996, 2004; Ciborra and Willcocks 2006; Hayes 2000; Heeks 2002; le Roux 2014; Magni et al. 2010; Molnar and Nandhakumar 2008; Orlikowski and Hoffman 1997; Teoh and Wickramasinghe 2011; Tjørnehøj and Mathiasen 2010)	Theory of creativity and spontaneity, Theory of bricolage and improvisation model of change, theory of workarounds	Organizational	Situational awareness, sense-making, mood, coping with limited resources, employee's creativity, motivation, empowerment in adaptation, embodied interactions in technology use, mediation, coordination, collaboration, and communication, experiences of misfits, system deficiencies, structural constraints, organizational readiness and practices, and employees' ability to execute a workaround
Appropriation	(Bar et al. 2007; Carroll 2004; Carroll et al. 2003; de Souza e Silva et al. 2011; Delaney et al. 2008; DeSanctis and Poole 1994; Dey et al. 2011; Dourish 2003; Fidock and Carroll 2011; Fuller and Dennis 2009; Lindtner et al. 2012; Orlikowski 1992; Rodon et al. 2011; Salovaara 2008; Salovaara et al. 2011; Stocker et al. 2012; Waycott et al. 2005; Wiredu 2007)	Structuration theory, Adaptive structuration theory (AST), Model of technology appropriation (MTA), Activity theory, Fit appropriation model (FAM)	Organization and individual	Motives, conditions of use, technology design properties, organizational structures, socio-cultural structures, embeddedness, unfaithful appropriation, system-task misfits, interpretive flexibility, and cognitive structures
Adaptation	(Ahuja and Thatcher 2005; Barki et al. 2007; Boudreau and Robey 2005; Boulus and Bjorn 2010; Convertino et al. 2007; Davidson and Chismar 2007; Davis and Hufnagel 2007; Desouza et al. 2007; Jaspersen et al. 2005; Mills and Chin 2007; Nan 2011; Park and Chen 2012; Rice and Rogers 1980; Saga and Zmud 1994; Schmitz et al. 2010; Singletary et al. 2002; Sun 2012; Tyre and Orlikowski 1994)	CAS theory, Coping theory, Theory of trying, Self-efficacy theory, Model of how people switch to active thinking from automatic thinking.	Organizational	Users' knowledge and skills, self-efficacy, benefits satisficing, benefits maximization, disturbance handling, self-preservation, novel situations, discrepancies in interaction, initiative to learn new uses, reflection-on-action, tinkering, learning new skills, adjusting work commitments, and self-adaptation
Customization and tailoring	(Germonprez and Collopy 2004; Germonprez et al. 2007; Germonprez et al. 2011; Hovorka and Germonprez 2011; Kwon and Kim 2011; Mathwick et al. 2010; Monk and Blom 2007; Oulasvirta and Blom 2007; Sundar and Marathe 2010; Sundar et al. 2012; Sunikka and Bragge 2012; Tossell et al. 2012; Wulf et al. 2008)	Theory of design, Personalization theory	Organization and individual	Sense of agency, autonomy and freedom, predictable decision-making process, exert control over system's functionality, users initiating actions on their own, innovativeness, aesthetic appreciation, resources embedded in the technology, and systems' affordances
Making the system's one's own	(Al Lily 2013; Allen et al. 2011; Barki et al. 2007; Harwood 2011; Hynes and Richardson 2009; Silverstone et al. 1992; Sørensen 2006; Sørensen et al. 2000)	Social shaping theory, Domestication theory, Activity theory, Actor network theory (ANT)	Organization and individual	Socio-cultural structures, social learning and influence, domestication, embeddedness, meaning ascribed, technology interactions, task-technology adaptation, and individual adaptation

Table 2A: Factors that Characterize Emergent Usage experience (UX) of IS				
Proposed Typology	The Literature Synthesized			Critical Realism Implication (Actual-Empirical Domains)
Perspectives of thought	References	Theory/Theories Used	Level of analysis	Factors that Characterize Emergent Usage Experience (UX) of IS identified from the Synthesized literature
Usage experience (UX) encompasses Usability	(Attfield et al. 2011; Avgerou and McGrath 2005; Hassenzahl 2003; Hassenzahl and Monk 2010; Jetter and Gerken 2007; Knijnenburg et al. 2012; Law and Abrahão 2014; MacDonald and Atwood 2014; O'Brien and Toms 2010; O'Brien 2010; Olsson 2013; Pallud and Straub 2014; Park et al. 2013; Thüring and Mahlke 2007)	Typology of experience model (Buccini and Padovani 2007), User experience (UX) model (Hassenzahl 2003), Component theory of emotions (Scherer 1984), Components of user experience (CUE) model (Thüring and Mahlke 2007), Duality of rationality and emotion in IS innovation (Avgerou and McGrath 2005)	Individual	Domain knowledge, demographic attributes, self-identification, choice goals, empowerment, situatedness, efficiency and meaningfulness, awareness, intuitiveness, control, trust, distrust, amazement, surprise, playfulness, liveliness, captivation, tangibility, connectedness, collectivity, privacy, inspiration, motivation, creativity, system's usefulness, usability, aesthetic value, symbolic meanings, motivation, affects, user engagement, branding experience, and user value
Usage experience (UX) distinct from Usability	(Beaudry and Pinsonneault 2010; Hartmann et al. 2008; Hassenzahl 2008; Hassenzahl et al. 2010; Hassenzahl and Monk 2010; Kujala et al. 2011; McCarthy and Wright 2004; Rousi et al. 2010; Saariluoma et al. 2013; Saariluoma et al. 2009; Van der Heijden 2004; Wixon 2011; Wright et al. 2004)	Self-determination theory (Ryan and Deci 2000), UX model (Hassenzahl 2003), Content-based user psychology theory (Saariluoma 2003; Saariluoma et al. 2013; Saariluoma et al. 2009)	Individual	Perceived enjoyability, aesthetic value or beauty, pleasure and fun, excitement, happiness, anger, anxiety, autonomy, competency, stimulation, relatedness, social values, emotional/hedonistic values, stimulation and epistemic values, respect and commitment, safety values, autonomy, cultural values, sense-making, apperception/apperceived IS usefulness, self-actualization, and motivation
Usage experience (UX) akin to Satisfaction	(Mavlanova et al. 2015; Morgan-Thomas and Veloutsou 2013; Román 2010; Rose et al. 2011; Xiao and Benbasat 2011; Xiao and Tan 2012; Yoon 2010)	Model of product-related deceptive information practices in e-commerce (Xiao and Benbasat 2011), Expectation Confirmation Model (ECM) (Bhattacharjee 2001), Signaling theory (Mavlanova et al. 2015), TAM (Davis et al. 1989)	Individual	User satisfaction, perceived ease of use, perceived benefits/usefulness, perceived deceptiveness of the system/website, and brand experience

The researcher not only identifies key concepts and their interpretations, but has the capacity to infer assumptions, even when they are not explicitly stated. This second round of data extraction and interpretation is generally known as double-hermeneutics. The double-hermeneutics is where that object researched as expressed in the literature and the researcher dialogically interact to co-inform the process of the theoretical interpretation beyond that present conceptualization. This is done in order to create an external abstract explanation of the concrete under study (Boell and Cecez-Kecmanovic 2014; Giddens 1984; Sayer 2000).

The mechanisms/experiential factors inferred/identified in Tables 1A and 2A are then theoretically coded into high-level categories as chains of inferences (Rycroft-Malone et

al. 2012), as shown in Tables 3A and 4A. Note also that Table 3A here is the same as Table 8 in the main thesis, while Table 4A is the same as Table 9 in the main thesis.

Table 3A: The Identified Potential Generative Mechanisms in the Real Domain and Contextual Conditions Source: Base on CAS Theory of IT Use (Nan 2011) and Organizational Emergence Framework (Alaa 2009)			
Enabling Structures	▪ Social structure ▪ Embeddedness and under-design ▪ Organizational structure ▪ Cognitive structure ▪ Modular and flexible IS architecture		
Dynamic Mechanisms	System functionalities ▪ System affordances ▪ Simplicity-in-design ▪ Adaptation ▪ Ambiguity into purpose of use ▪ Transparent interactions ▪ Technological mediation ▪ System-task misfits ▪ Versatility and self-reinforcement	Empowerment ▪ Empowerment ▪ Exert control ▪ Initiative actions	Cognitive capacities ▪ Creativity ▪ Initiative to learn new uses ▪ Endowed expertise ▪ Technological cognizance
	Personal Characteristics ▪ Sense-making ▪ Autonomy and freedom ▪ Motivation ▪ Innovativeness ▪ Mood	Social influence ▪ Social learning and influence ▪ Coordination ▪ Collaboration ▪ Communication ▪ Playfulness and exploration	Situational conditions ▪ Situational awareness ▪ Coping with limited resources ▪ Unfaithful appropriation ▪ Novel situations ▪ Discrepancies in interaction ▪ Domestication ▪ Local control of job environment ▪ Environmental uncertainties
Control Mechanisms	Self-Adaptation ▪ Software incremental adjustments ▪ Reflection-on-action ▪ Tinkering and learning ▪ Adjusting work commitments		
Technology operating Contexts	▪ Organizational/workplace systems ▪ Individual/mobile technologies ▪ Individual/e-commerce		

Table 4A: Experiential Factors that Characterize Emergent Usage Experience (UX) of IS at Actual-Empirical Domains Source: Based on Duality of Emotion and Rational Framework of Avgerou and McGrath (2005)
▪ User empowerment ▪ User engagement ▪ User satisfaction ▪ Apperceived usefulness of IS ▪ Perceived deceptiveness of the system ▪ Security and privacy concerns

By integrating Tables 3A and 4A, the conceptual framework was developed as an answer to the review question, or in fulfillment of the review objective. The conceptual framework is shown in Figure 3A here, but in the main thesis it is in Figure 12. Note that CAS theory for IT use (Nan 2011), CAS theory for organizational emergence (Alaa 2009), and critical realism meta-theoretical assumptions were used to establish the relationships among the generative mechanisms and the experiential factors in the conceptual framework.

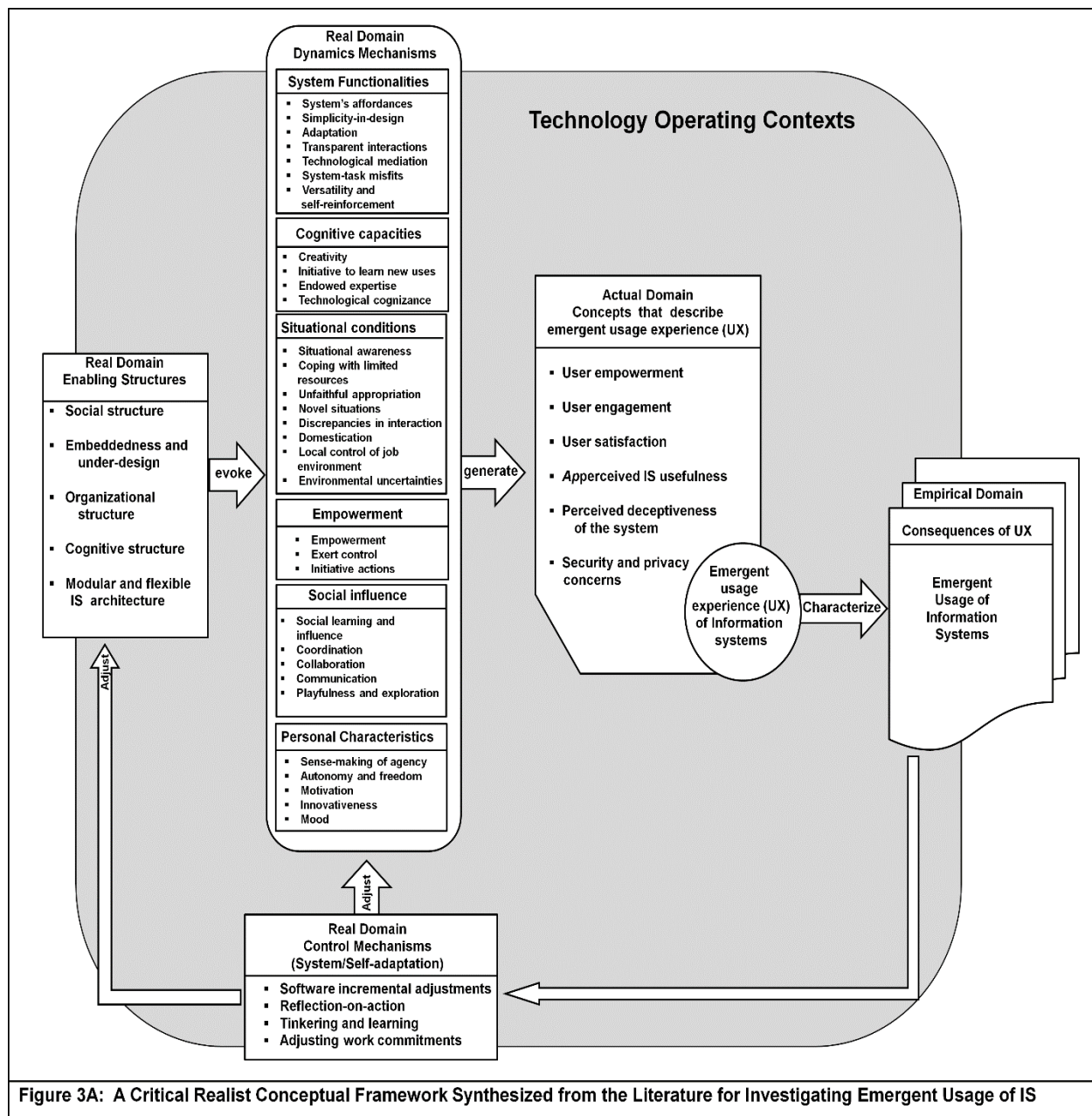


Figure 3A: A Critical Realist Conceptual Framework Synthesized from the Literature for Investigating Emergent Usage of IS

The conceptual framework identifies the generative mechanisms that could explain systems' emergent usages. At the same time, it holds the non-causal experiential factors that could describe systems' emergent usage (Pallud and Straub 2014; Pucillo and Cascini 2014). As shown in Figure 3A, the model has the enabling structures as social structure, embeddedness and underdesign, organizational structure, cognitive structure, modular and flexible IS architecture, which altogether in interaction evoke the effectiveness of the dynamic mechanisms. The dynamic mechanisms are classified into higher levels of system functionalities, cognitive capacities, situational conditions, empowerment, social influence, and personal characteristics. These higher levels hold smaller and more exclusive mechanisms as shown in Figure 3A.

The enabling structures, when viewed in relation to the dynamic mechanisms, generate emergent usage of IS experience as outcomes. Such outcomes are characterized by user empowerment, user engagement, user satisfaction, apperceived usefulness of IS, systems perceived deceptiveness, security, and privacy concerns. The emergent usage outcomes influence the control mechanisms such as software incremental adjustment, reflection-on-action, tinkering and learning, and adjusting work commitments. Over time, the control mechanisms are used to introduce the reciprocal causal mechanisms which, in turn, re-adjust the enabling structures and the dynamic mechanisms to ensure a balanced emergent usage IS use on the basis of UX. The enabling structures, dynamic mechanisms, and the control mechanisms reside in the real domain, the factors that characterize the emergent IS use are in the actual domain, while the emergent IS use outcomes are domiciled in the empirical domain. These structures and mechanisms are assumed to interact within the technology's operating contexts, which in turn shapes the behavior of the interaction.

Appendix B



CONSENT TO PARTICIPATE IN A Ph.D. RESEARCH STUDY UNIVERSITY OF CAPE TOWN (UCT) SOUTH AFRICA

TOPIC: MECHANISMS FOR EMERGENT USAGE OF ADAPTIVE INFORMATION SYSTEMS: A CRITICAL REALIST CASE OF e-FINANCIAL SYSTEMS IN SOUTH AFRICA

PRINCIPAL INVESTIGATORS:

Names: *Chidi Ononiwu and Prof. Irwin Brown*

INTRODUCTION:

As a user of 22seven.com or your organization as well as the e-banking communities, we are pleased to invite you all to participate in the above-named Ph.D. research project at UCT. We use this medium to provide you with information that will enable you to consider whether you can participate. Our research is governed by the UCT ethics committee guidelines for research, which must be strictly followed to protect our participants' privacy. We attach a consent form for you to sign if you decide to participate, and a copy of the signed form will be given to you as well.

STUDY PURPOSE:

Through this study, we seek to identify the mechanisms that could generate emergent use of an e-financial service-system in South Africa, popularly known as 22seven.com. We are also interested in identifying the experiential factors that could describe such an information system's use in South Africa. Therefore, for you to participate, you must have used or be still using the technology. Developer of the technology and all other e-financial communities are highly encouraged to participate, since there is no way we can conduct this research without you.

DURATION

For participant observation in the case organization, our stay with the organization shall be determined in due course. Interviewing of users within and outside the case organization will be about 45-90 minutes for each participant/group of participants. The interview will be tape recorded. Please find attached the interview protocol.

REASONS FOR YOUR SELECTION TO PARTICIPATE

You qualify as a possible participant in this interview because of being the designer of this innovative technology or the user of it, as well as your willingness and enthusiastic attitude to participate.

STUDY PROCEDURES AND CONFIDENTIALITY:

If you decide to participate, we will ensure that the confidentiality of all of your responses is upheld at all times during and after the research project. Participant ID # will be assigned to you throughout this study. The ID number is useful to enable us to conduct relevant cross-sectional analyses and still retain the confidentiality.

STUDY RISKS:

There is no risk for participation. We only envisage the possibility of psychological risk if your answers to the interview questions are divulged to any third party. Therefore, to limit such a risk, we will maintain a strict control over all data and store them in an electronic file/database with password protection. Your assigned participant ID # will also reduce the risk of tracing your answers back to you. Access to the protected file will be limited to me as the principal researcher and my supervisor.

STUDY BENEFITS:

As our case organization, this study can provide you with intervention strategies. As a user, interesting insight on the use of the technology might be gained from our research. You will also be given a copy of the research study, if you so wish.

VOLUNTARY PARTICIPATION:

The decision to participate is entirely yours and the participation remains voluntary throughout the duration of the research project. You are free to withdraw at any time and your decision will not affect your relationship with the researcher or with the university. Signing the consent form does not waive any of your legal rights.

CONTACTS:

We will be very pleased to respond to any of your questions. You can also contact us if any further inquiry is needed.

Chidi Ononiwu: gerrychi@gmail.com or onnchi001@myuct.ac.za

Prof. Irwin Brown: Irwin.Brown@uct.ac.za or phone at 617-627-5217.

STATEMENT OF CONSENT:

I have reviewed the interview design/participant observation outlined and have had my questions about the research answered to my satisfaction. I understand that my participation is voluntary and that I can withdraw from the interview/participant observation process at any time without prejudice. Signing this form does not waive any of my legal rights.

By signing below, you are indicating that this consent form has been explained to you, that you understood it, and any questions you have about the interview or participant observation process have been answered. You are indicating that you understood the ways the interview/observation data may be used and how your privacy will be protected. By signing this form, you are agreeing to participate in the interview/observation process at this time only.

I ACKNOWLEDGE THAT I HAVE READ THE ABOVE EXPLANATION OF THIS STUDY THAT ALL OF MY QUESTIONS HAVE BEEN SATISFACTORILY ANSWERED, AND I AGREE TO PARTICIPATE IN THIS INTERVIEW/PARTICIPANT OBSERVATION.

----- Signature of Participant

----- Printed name of participant

----- Participant ID #

Date -----

I, THE RESEARCHER CERTIFIES THAT I HAVE EXPLAINED FULLY TO THE ABOVE SUBJECT THE NATURE AND PURPOSE, PROCEDURES AND THE POSSIBLE RISK AND POTENTIAL BENEFITS OF THIS RESEARCH PROJECT.

----- Signature of principal researcher Date -----

Appendix C

RESEARCH PROTOCOL AND INTERVIEW QUESTIONS

Research Questions

RQ4 *What factors describe users' emergent usage experiences with adaptive information systems?*

RQ5 *What generative mechanisms must exist for such emergent usage to be possible?*

RQ6 *What theoretical model explains the relations of the mechanisms to effect emergent usage of such information systems?*

As illustrated in Table 1C, the protocol followed in the interviews began with simple question(s) to get amiable interaction between the researcher and interviewee established. The simple questions were also used to elicit background information from each of the participants.

It must be emphasized that the interview questions are used to elicit raw data for analysis. Such questions are not direct answers to the research questions, nor does it directly lead to the generative mechanisms. Structures/mechanisms are not uncovered by interviewing people in depth about them (Archer 1998). Rather, the raw data are used to infer the generative mechanisms' existence from the participants' observable activities, actions, and experiences, that are encapsulated in their verbalized discourse.

The observable participants' activities, actions, and experiences are captured as mechanism effects or demi-regularities, over a definite region time-space (Miller and Tsang 2010). Therefore, to support inferences from interview data, a number of other data sources were collected and analyzed. They include documentations, blogs, photographs, participants observation of use of the system, operations in the system context, and reviews of public information about the organizational and social contexts in which the actors and the technology operate. Thus, *“[e]ven if a particular mechanism is not directly observable, the more observable effects that logically are attributable to*

the mechanism, the more compelling the case for its presence” (Miller and Tsang 2010, p. 148).

As the interviewing progression deepens, probing questions in the protocol emerged, to elicit details that were salient to the research questions, if those details had not already emerged during the account of the main interview questions.

Table 1C: Mapping Interview Questions to Research Questions, Theoretical Constructs, and Contextual Goals for Investigating Emergent Usage of Adaptive IS (e-Financial Service Systems)

Interview Questions	Phases of Research Design	Theoretical Constructs	Contextual Goals (Chapters 5 and 6)	Research Questions	Rationale
22seven management					
What prompted the management to initiate this kind of technology?	Phase 1				Manages entry by setting the stage. Starting with this question allows the interviewer and interviewee to acclimatize with the environment that has now become the object of investigation. Also, this question collects some background information about the interviewee that may speak to their motivation and skills.
How will you describe the South African e-financial environment? Are there any situations in South African banking environment that affect the use of the technology?	Phase 1	Information asymmetrical structure of the financial institutions operating in South Africa	To describe the South African e-financial ecosystem within which the technology is situated and functions	RQ2	Answers to these interview questions are used to infer any socio-economic macro structures that may be shaping the system's emergent usage.
Does any evidence suggest that users engage with your technology (website) in emergent ways?	Phase 1	Emergent usage		RQ1 and RQ2	To abstract the object of investigation as the outcomes in order to confirm its existence (Collier 1998; Danermark et al. 2002; Sayer 1992)
How has your organization's structure influenced the novel use of your technology?	Phase 1	Organizational structure	To understand the case organization, its structure, business model, and daily works		With this kind of understanding the researcher can infer the causal structures that pertain to the organization and its

In which ways do your work activities influence the novel use of the technology?			activities/experiences of the key employees relevant to this research. Understand events that occur starting from the launch of the system to users' acceptance and appropriation		environment relevant to the system's emergent usage.
Apparently, the technology has hit a near critical mass in terms of usage, despite the earlier critiques from banks. What do you think are the reasons behind the users ignoring the banks' earlier warnings not to embrace the technology?	Phase 2			RQ1 and RQ2	Open questions that elicit underlying mechanisms and experiential non-causal factors
What design features of the technology best enhance the technology's emergent usage?	Phase 1	Embeddedness and under-design	To have better insights into the unique characteristics and features of the system	RQ2	To elicit embeddedness and under-design mechanism. Offering a richer conceptualization of the IT artifact under study, its context, purpose, and beneficiaries of its functions, (b) defining the concept of the IT artifact in a clearer and more encompassing fashion, (c) paying more attention to the materiality of the technology in question (Orlikowski and Iacono 2001, pp 7-10)
You talked about emotions in a highly rational environment, so how has emotion fostered your website's novel use? In general, how have you perceived the experiences of your users?	Phase 2	Experiential and emotional factors		RQ1	Open questions that elicit emotional/experiential factors

Is there any more information on your technology you would like to share with me?					Elicits further insights that the interviewee may have about the object under investigation. Sets the stage for the exit phase of the interview
Designers and User Group					
How did you develop such a valuable e-financial technology (website)?	Phase 1				Manages entry by setting the stage. Starting with this question allows the interviewer and interviewee to acclimatize with the environment that has now become the object of investigation. Also, this question collects some background information about the interviewee that may speak to their motivation and skills.
Does any evidence suggest that users engage with your technology in an emergent way? Could you tell me about how your team deploys and supports the software package of which emergent usage is the focus?	Phase 1	Emergent usage Agile responsiveness, Collaboration and communication, Organizational supportiveness	To understand the daily work activities, actions, and experiences of the designers	RQ1 and RQ2	To abstract the object of investigation as the outcomes in order to confirm its existence (Collier 1998; Danermark et al. 2002; Sayer 1992). Identify agile responsiveness, collaboration and communication, and organizational supportiveness
What were the main challenges and issues in 22seven designs during deployment or since it has been available for public use? Do such challenges and issues conflict with the users' needs since it has been available for public use? How were the conflicting issues resolved?	Phase 2	Dialectical flux of trust and distrust, Situational abnormality and suspicion, Perceived deceptiveness of the system	To understand and describe the activities, forces and resistances trailing the launch of the system to users' acceptance, appropriation, and the context the technology functions	RQ1 and RQ2	To identify and empirically corroborate the existence of dialectical flux of trust and distrust mechanism and their enabling conditions i.e., situational abnormality and suspicion. To empirically corroborate the existence of experiential factor - perceived deceptiveness of the system

What were your main design tasks in the 22seven.com operations? How did you consider the technology's design in terms of servicing your users? How does its novel use aligned with your design?	Phase 2	System affordances, Embeddedness and under-design	To understand the daily work activities, actions, and experiences of the designers. To understand and describe the characteristics and features of the technology.	RQ2	To identify and empirically corroborate the existence of system affordance, embeddedness and under-design
How do you support user requirement changes? How do you support users who perceive or experience the fact that the inherent characteristics of the technology is obstructing their task accomplishments?	Phase 2	System misfits and ease-of-workaround		RQ2	To identify and empirically corroborate the existence of System misfits and ease-of-workaround. Flags critiquing, reflection and learning, and iterative post-releases as feedback mechanisms
How do you designers adjust to changing contexts-of-use since successful service mediation requires adaptation capabilities of the technology as well as the evolution over time of contexts?	Phase 2	Critiquing, reflection and learning, and iterative post-releases as feedback mechanisms		RQ2	To identify and empirically corroborate the existence of critiquing, reflection and learning, and iterative post-releases as feedback mechanisms. Flags the present of technology mediation
What about evaluation? How do you think the software is working? What sort of sense do you have of how well people are using it and liking it? How well would you say the features of the technology work? Does it behave the way you expect it to?	Phase 2	Critiquing, reflection and learning, and iterative post-releases as feedback mechanisms		RQ2	To identify and empirically corroborate the existence of critiquing, reflection and learning, and iterative post-releases as feedback mechanisms
What are the security and privacy aspects provided with the technology? How did the users perceived them? How did you ensure security/privacy of users' financial data and other regulatory requirements?	Phase 2	Security and privacy concerns		RQ1	To identify and empirically corroborate the existence of security and privacy concerns

What are other concerns you have about secure interactions? What can be done to alleviate users' anxieties associated with such concerns?					
Having seen the research model, does it fit with what you think is happening in the phenomenon? Do you agree or disagree with it, and if agreed why? And if not, why not? Which structure/mechanism do you suggest as being responsible for the emergent usage of this application? Which experiential factors would describe its characteristics? How does the structure/mechanism/factor you selected capture the phenomenon under investigation? How can such a structure/mechanism/factor be supported in this context?	Phase 2	To empirically corroborate the research model with the empirical data		RQ1, RQ2 and RQ3	Realist interview (Pawson and Tilley 1977; Smith and Elger 2014)
Is there any more information on your technology you would like to share with me?					Elicits further insights that the interviewee may have about the object under investigation. Sets the stage for the exit phase of the interview
Actual Users of technology					
How are you using 22seven.com? What was your initial understanding about 22seven in terms of why you decided to use the technology?	Phases 1 and 2				Manages entry by setting the stage. Starting with these questions allow the interviewer and interviewee to acclimatize with the environment that has now become the object of investigation. Also, this question collects some background information about the interviewee that may speak to their motivation and skills.

How does the system shows misfits or not align with your needs? What do you do when you experience or perceive the inherent characteristics of the technology as obstructions to your task accomplishments? How does your experiences of misfit encourage novel usage and system reinvention practices? To what extent does the system misfits obstruct your ability to utilize the technology to achieve your task outcomes? How did you circumvent or work-around it?	Phase 2	System misfits and ease-of-workaround		RQ2	To identify and empirically corroborate the existence of System misfits and ease-of-workaround mechanisms. Flags and supports the existence of critiquing, reflection, and learning mechanisms
In what ways do the technology depict possibilities for your action? Did you think about it or it just came by observing the user interface of your Smartphone/Tablet/desktop? How did the widgets appeal to your intuitiveness and which ones do you mostly use? What are your main task accomplishments using such widgets? Can I share your experiences?	Phase 2	System affordances		RQ2	To identify and empirically corroborate the existence of system affordances. Flags personal innovativeness in IT (PIIT) and technological cognizance mechanisms
How did you get to use the technology? How difficult or easy for you to learn it or use it? How do you creatively use the technology when you perceived its affordances to meet your financial service needs?	Phase 2	Personal innovativeness in IT (PIIT)		RQ2	To identify and empirically corroborate the existence of personal innovativeness in IT (PIIT). Flags technological cognizance
How did you come to be very knowledgeable in the use of the technology? Do you think your good knowledge of the system determines your emergent use? And if yes, how difficult or easy is it for you to create novel uses (prompts internal and external capabilities/constraints).	Phase 2	Technological cognizance		RQ2	To identify and empirically corroborate the existence technological cognizance

What problems did you encounter? How did you solve them? How confident are you to create novel uses despite the said difficulties? How easy is for you to remember your past activities/usage experiences when you revisited the technology?					
What were the main challenges and fears in the use of the technology? Do such challenges and fears influence the use of the technology in a novel way? How were the challenges and fears resolved?	Phase 2	Dialectical flux of trust and distrust, Situational abnormality and suspicion, Perceived deceptiveness of the system, security and privacy concerns.		RQ2	To identify and empirically corroborate the existence of dialectical flux of trust and distrust mechanism and its enabling conditions i.e., situational abnormality and suspicion. To empirically corroborate the existence of experiential factor - perceived deceptiveness of the system and security and privacy concerns
How has the South African financial environment influenced your use of 22seven.com? What are your main task accomplishments in the technology when influenced by South African e-financial ecosystem?	Phases 1 and 2	Information asymmetrical structure of the financial intuitions operating in South Africa	To describe the South African e-financial ecosystem within which the technology is situated and functions.	RQ2	To identify and empirically corroborate the existence of Information asymmetrical structure of the financial intuitions operating in South Africa
What is your perception about 22seven.com? How does its service mediating role empowers you to save and invest? How did you perceive its advancement on you to save and invest your money as kinds of personalized uses of the technology? Why do you allow the evolution of such use over time? Was its role as technology mediators recognized, sanctioned, or supported by you? Can I share your experiences with such use over time?	Phase 2	Technology mediation mechanism, experiential factor – perceived deceptiveness, empowerment		RQ2	To identify and empirically corroborate the existence of technology mediation and experiential factor -perceived deceptiveness of the system, empowerment

What about evaluation? How do you think the software is working? How well would you say the features of the technology work? Does it behave the way you expect it to?	Phase 2	Critiquing reflection, and learning		RQ2	To identify and empirically corroborate the existence of Critiquing, reflection, and learning
How has the technology empowered you? Can I share your experiences? You did mention about monitoring and surveillance, reflectiveness and control of your banking activities. How has the technology fared in these areas. Can we take them one by one? How do you creatively use the technology?	Phase 2	User empowerment		RQ1	To identify and empirically corroborate the existence of User empowerment
Where did you use the mental imagery of your past interactions to achieve IS usefulness? How did you go about it? How did you extract the sense to adapt the technology from your usage experience? How did you feel when you achieved that?	Phase 2	Apperceived IS usefulness		RQ1	To identify and empirically corroborate the existence of Apperceived IS usefulness
How satisfied are you with the technology after your usage experience? To what extent does it meet your expectations? How well did 22seven.com services compared with the ideal type offerings?	Phase 2	User satisfaction		RQ1	To identify and empirically corroborate the existence of User satisfaction
What are your concerns about the perceived vulnerability of the technology? How did you address security/privacy regulatory concerns in the technology?	Phase 2	Security/privacy concerns		RQ1	To identify and empirically corroborate the existence of Security/Privacy concerns

Having seen the research model, does it fit with what you think is happening in the phenomenon? Do you agree or disagree with it, and if agreed why? And if not, why not? Which structure/mechanism do you suggest as being responsible for the emergent usage of this application? Which experiential factors would describe its characteristics? How does the structure/mechanism/factor you selected capture the phenomenon under investigation? How can such a structure/mechanism/factor be supported in this context?	Phase 2	To empirically corroborate the research model with the empirical data		RQ1, RQ2 and RQ3	Realist interview (Pawson and Tilley 1977; Smith and Elger 2014)
Is there any more information on your technology you would like to share with me?					Elicits further insights that the interviewee may have about the object under investigation. Sets the stage for the exit phase of the interview

Bank officials					
How do you perceive the operations of 22seven.com among banking customers out there? Having seen the research model, does it fit with what you think is happening in the phenomenon? Do you agree or disagree with it, and if agreed why? And if not, why not? Which structure/mechanism do you suggest as being responsible for the emergent usage of this application? Which experiential factors would describe its characteristics? How does the structure/mechanism/factor you selected capture the phenomenon under investigation? How can such a structure/mechanism/factor be supported in this context?	Phases 1 and 2	To empirically corroborate the research model with the empirical data	To describe the South African e-financial ecosystem within which the technology is situated and functions	RQ1, RQ2 and RQ3	Discordant tones from the bank officials, having resisted the operations of the system initially.
Is there any more information on your technology you would like to share with me?					Elicits further insights that the interviewee may have about the object under investigation. Sets the stage for the exit phase of the interview

Appendix D

Table 1: Chains of Evidence: Empowerment Experience				
Unit of Analysis: Paragraphs from the Dataset	Basic Theme	Organizing Theme	Inductive-deductive coding (Researcher's theoretical memo)	Global Theme (Experiential factor)
No matter where the transactions took place or the bank my accounts are resident, <u>I use 22seven dashboard to have a coherent view of my transactions. Then I used that information to build reports of my overall net worth. With such a view investment decisions happen at the snap of my finger.</u> (#U1) With 22seven dashboards on my iPad, I have my total accounts anywhere I go even if I go overseas. <u>With it, I take control of my finance by setting up multiple accounts and view the overall activity without worrying about my monthly account statement. I also prepare my tax returns and submit it from my iPad online.</u> (#U9) 22seven gives me access to compose solutions to my needs. <u><How? The researcher asked> I usually used its location widget and integrate it with my iPhone GPRS to locate the nearest ATM of my bank. You know interbank ATM services charge a little higher. So I insist on using my bank's ATM where ever I go to save cost.</u> (#U12) <u>We foresee what they might need and provide the content and the tool to help them. In that process, we also learn from the users. Most times we see some fantastic maneuvering of the features of our website by our users to achieve their individual goals, even to our bewilderment.</u> Aha! It gives us encouragement that we are in for something. (#SD1) The empowerment I experienced in the 22seven has motivated me a lot and most times I feel very happy and rewarding that I could use the technology in that way to meet my needs. (#U30)	Empowering users to have a total view of their accounts. Reflecting on the view for action. Users taking control of their finances. Set up multiple accounts Empowering users to create solutions Individual users actualize their new ideas about how the system features can be used and these ideas are encouraged to be put into use by the designers in the organization	Panoptic Empowerment Reflection Empowerment	Probing Question (PQ) What is this expression [in the text or data] an example of? Answer to the PQ Empowerment experience	User Empowerment
Our service doesn't have all the answers, but it does have a few insights. 22seven is developed with the idea that if we become more aware of why we make the decisions we do, <u>we will be in a better position to make smarter money choices by tweaking its features to suit our financial behaviors</u> (#SD5).	Tweaking the features of the technology to suit users' preferences	Creative Empowerment		
22seven.com provides me with personalized instructions in dealing with my financial needs. And <u>I can easily change my previous choice if the need arises.</u> It is amazing <u>to see how flexible the website is</u> (#U10)	A user can easily change his/her previous choice if the need arises	Autonomy		

Table 2: Chains of Evidence: *apperception* of IS usefulness

Unit of Analysis: Paragraphs from the Dataset	Basic Theme	Organizing Theme	Inductive-deductive coding (Researcher's theoretical memo)	Global Theme (Experiential factor)
The technology is indeed useful. <u>One time I really needed my bank's ATM in Grahams town Art festival I hadn't visited before ... so I whipped out my iPhone, fired up 22seven location widget and mash it up with my iPhone's GPRS. Quickly, here comes the ATM on the other side of the street I just missed. That got me in a better mood: I walked back to that street and get some money. I was amazed about technology and the time it saves.</u> (#U23) I benefit a lot from 22seven. <u>The monthly budget widget on my phone is a great tool.</u> It gives me a more in-depth view of my monthly finances and my overall spending. Over time, I use it to analyze my net worth and review my financial progress. I can tell you, my financial prudence has tremendously improved with 22seven (#U26) Tweaking the website on my iPad to understand my income-to-debt ratio at all times is a positive experience. <u>A widget is there for me to do just that without any assistance. I create budgets based on my financial goals, and the technology shows my actual spending versus what was budgeted.</u> (#U27) I use 22seven to manage <u>an investment property more efficiently because of the reputation of Old Mutual. I use it to apply for a new home loan in Old Mutual with the mindset of savings.</u> Presently, I co-join with my family to buy a new home and so our contributions are brought to view the way that would have been difficult for us to manage without 22seven (#U6)	Usefulness is aligned with context sensitivities Useful for monthly budget and analyzing net worth Pleasurable interactions based on the functionalities of the technology	Appropriateness in the context Visually attractive	Probing Question (PQ) What is this expression [in the text or data] an example of?	

<u>Our visual design turns users on to complete their tasks and maximize the widget functionalities.</u> We are aware if the application doesn't have the right kind of aesthetic value, it will not only fail to attract the user's attention, it will also fail to hold their attention. (#SD2) <u>There is a refreshing sense of adventure when using 22seven to check my accounts. I love the encounter of income and expenses presentation-</u> very graphic and gamified. I had mixed emotions: "Whoa, did I earn that much?!" was followed by "No, no, no, where did it go then? To, yes, yes, yes, here it is, you spent it and none else, oho! (#U19) <u>Unlike others, I don't get unsolicited ads while I'm using the technology</u> #U5 <u>I have easy access to my financial transactions from my iPhone</u> #U11 <u>It looks like internet banking website</u> #U14 <u>I'm not confused by the information highlighted</u> #U 10 <u>The information on my tablet is laid out as in real life for me to see</u> #U28.	The Widget functionalities on the user interface is visually attractive Emotionally derived output in a task oriented domain Devoid of distractions and intrusive tendencies Recognizable environment Information output is of good qualities in a mobile device	Pleasurable interactions	Answer to the PQ Apperception of IS usefulness	apperception of IS usefulness

Table 3: Chains of Evidence: Privacy and security concerns

Unit of Analysis: Paragraphs from the Dataset	Basic Theme	Organizing Theme	Inductive-deductive coding (Researcher's theoretical memo)	Global Theme (Experiential factor)
Security and privacy concerns are the reasons most bank clients don't use 22seven. My personal information could be used without my knowledge. <u>Laying bare the details of all your holdings in one place is a scary thought, since it would only take one shrewd hacker to get his grubby hands on the data and wreak havoc. It's like keeping your ATM card and PIN ID in the same wallet. It's just bad personal security.</u> (#U20) <u>Yeah, they told me that my 22seven account is anonymous; set up requires only an email and my password, but my question really is why does it then ask for my bank details?</u> No way in hell, am' I gonna log in into 22seven again. (#U28) <u>Issues of security and privacy risks are serious concerns for us as designers and that's why we placed our privacy policies on our webpage. We have also deployed bank level security in our network and we don't see it being compromised.</u> <Why the researcher asked? >, we don't keep deposits, and even users' banking details are not with us, they are encrypted and stored by Yodlee. <u>So breaking into our website is not rewarding to any hacker. All these we have done, but whether our users see it that way is a different ball game.</u> (#SD5) <u>Individual's risk averse has its role in 22seven. That is certain, but to us, we use the system despite its envisaged security challenges. A mobile app that gives you a self-audit of your financial position might not be found elsewhere in SA [South Africa]. Besides, if hackers could break into 22seven, the same could be</u>	Security and privacy issues due to inputting banking details on the internet Security and privacy concerns are common challenges. Despite such challenges shrouding the system's usefulness, user-system interactions	Security concerns Privacy concerns	Probing Question (PQ) What is this expression [in the text or data] an example of? Answer to the PQ Privacy and security concerns	Privacy and security concerns

done with my banks' database since they use the same security encryptions like the banks. (#U15)	continue to receive a positive experience			
Some information is more sensitive than others, especially money matters. <u>I find it quite uneasy with 22seven on my iPad when with my partner. you know what I mean.</u> The interviewee pauses, smiles... and then exclaims... Damn! , there is no hiding place, men! (#U8)	Spatial contextual issues and socialness escalate privacy concerns			
I don't fully trust 22seven because I always think about its safety. As far as I am concerned it might not be secured as claimed by Old mutual. (#U23)	Lack of total commitment to its use due to security issues			
<u>I used it but I am afraid to lose my bank's PIN number to internet frauds.</u> (#U25)				

Table 6: Chains of Evidence: Embeddedness and underdesign mechanism		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
First, we script prepackaged tasks functionality that provides value to initially entice and hook end-user communities. The final ingredients are left half-way for them to fill using their widgets in their contexts of use. At times, we noticed abandonment of the process, but most times users continued because of the rewarding value in accomplishing the tasks. (#SD3) I usually create tags to add comments to my spending transactions that weren't specified in the website. The beauty of the comments is that it provides the context wherein the transactions took effect. Last month, I paid a traffic fine in Cape Town so it shows up on my transaction list as Cape Town. Then it is categorized automatically under grocery which is okay because I don't want to create a separate category for fines. So what I did was to attach a 'note' on the transaction reminding me what it was. Overtime the technology recognized my comment tags and automatically creates it for me once I tapped on the widget on my iPad. (#U21) We take the scripting of codes that govern the functionality and the domain of users' responsibilities very seriously. That also includes contractual agreements, institutional laws, security and privacy policies that guide users' behavior. Since we do not have the in-house expertise of scripting such codes we outsource them to Yodlee who provides us with bank level security that we link to the functional routines of our system.(#SD4) We don't sell financial products at 22seven. <u>We make content, tools and financial insights that users appropriate to make decisions when purchasing financial products (#SD2)</u> <u>We script contents to reflect real financial transactions. We don't build products that are full solutions, but the contents that really need to be incorporated by the user to create a solution.</u> The solution can then be purchased in Old Mutual or any other financial institutions or in combination of them (#SD3) Most times we check the profiles of our users whose demand are far off, We surreptitiously make a local adaptation for that specific user and placed it in <u>his/her "own library"</u>. The library is then linked to the icon widgets on his/her screen. We then monitor and see the usefulness of the local adaptation, we can then generalize it to all users in our next 'version' if necessary (#SD1)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Embeddedness and underdesign mechanism. Designers script the financial routines and embodied them into software artifacts as content and tools. Users use the content and tools in their context-of-use	Embeddedness and underdesign mechanism

Table 7: Chains of Evidence: Information asymmetric structure		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
Our deal with banks in SA is opaquely done and it has been so for ages. I have no other option than to engage with 22seven to confront banks secrecy of servicing my accounts since they don't embrace the idea of accessibility. Banks in SA lock clients into their foggy ecosystem – and that mentality is being exposed by 22seven. (#U5) A de-service that needs to be challenged for it has been the norms for us to notice the discrepancy between stated interest rates and actual interest charged. Take my own case, for example; my bank's interest rate quoted before contracting the loan was 4% per month. Instead of translating to 48% it surreptitiously turns into an annualized percentage rate (APR) greater than 90% when the details are exposed by 22seven in the following manner. First and foremost, the interest is calculated at 4% based on the initial balance of the pay down principal. Instead of the monthly charges, the interest is charged every four weeks to arrive at a 13 payment cycle within one year rather than 12 as contractually agreed. They also charge 2% as a mandatory savings provision, which comes out of the initial loan amount. This is excluded from the 4% specified interest on the total loan amount. Thereafter, an upfront fee, for operating or servicing the loan is deducted from the loan received and also included in the interest calculation. In the entire process, I was in essence charged a 90.8% APR on a loan advertised as 4% when I used 22seven to compute it all. Do you see how I was blindfolded and ripped off by my bank? (#U16)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Information asymmetric structure	Information asymmetric structure

I recently sign-up with 22seven to monitor my ABSA business account and I have been watching with shivers as they suddenly hiked up all my fees, without informing me. Now, instead of the flat fee I used to pay for all transactions, I've begun to pay what appears to be a percentage based fee for two years. Not once did they bother to ask me about it, let alone give me a call. I have to ring them up to have that reversed. (#U11)

I must commend 22seven for helping us to regain the visibility of our mortgage credits with different banks in SA, the service banks should have probably given us. They compel us to relate with them blindfolded probably because too many of them appear to have read Adam Smith's "wealth of nations" and totally ignored his "theory of moral sentiments". Otherwise, how could one explain the securitization of my mortgage credit without my consent, only to be alerted by 22seven here on my iPad?. I foresee that happening so I configure the website to monitor it for me. Even when I called my account officer, she claimed ignorance of such. You know what that means, my contractual obligation has shifted from the bank I took the loan to now an unknown investor that purchased the security. Presently I have informed my lawyer and we will take it up from there. I'm really peeved about being left out of the whole deal. (#U13)

22seven allows us to have a clearer view of our financial activities in the way we want it unlike the banks. By comparing products of other banks gives everyone a better view of what drives the financial market (#U1).

I think the security "issue" banks are screaming about is masking their nervousness that we might see through the obfuscation they create in our accounts by using 22seven (#U22)

Customers want to have visibility and gain control of their money. It is rather unfortunate that banks better positioned to do so are very reluctant in providing them that facility. Rather, technology is used more to themselves instead of focusing it on the customer. Also, due to the democratization of information, customers are demanding their right to information, especially their financial information. When we see this, we cash-in on it to develop 22seven.com (#M2)

Table 8: Chains of Evidence: Organizational structure		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
We can only survive with an organizational structure that enables us to adapt to the financial market pressures. Our structure prioritizes individual interactions that most aligns with market volatility. With such a goal, we can respond to changes in the technology (#M2) The e-financial market is embedded with volatility, so we need to precede market demands with organizational adaptability. If we don't have a structure to support that, then we will be out of business (#M3). Collaboration among team members is critical and we emphasized it during our regular stand-up meetings. Each member has a voice that must be listened to. We are at ease to share opinions and ideas despite our varied expertise. A team can reach out, without problems, to other teams for support as this is an ethos that extends beyond the organization even to our users. (#SD3) We take the issue of collaboration and communication too far, even at use time. We see 'use' as the system in communication and collaborating with the users. Therefore, errors occurring in the system are signs that the system is not in collaboration no matter how the user swing the system especially within the windows of our design. So we design to eliminate system malfunctioning through knowledge sharing among our diversified teams and users' feedback. (#SD4) Our structure obvious the underlying collaboration among diversified teams and the trust they have among themselves. Because of that we are better positioned to respond to users unanticipated uses with people that have different levels of experiences and different skill sets. (#M2) Software designers are generally quiet introverts. So we must get collaboration happening. But sometimes it's difficult in practice. You really have to make a point of getting collaboration to happen. If one is not talking, you got to stir him up to have a clear idea of what happens in that arm of	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Fluid routineness + diversity of expertise+ collaboration and communication+ responsiveness altogether encapsulated in Organizational structure	Organizational structure

software he is working on, especially in our regular face-to-face meeting (#SD3)

With our experienced and diverse teams, user support is highly responsive. Our users appreciate us when we diagnose their problems while on the phone or chat and then push out the fix just a few minutes later. (#SD5)

Some of our users want us to add additional features, which were never in the scope of our business or we found it to be unethical or constitutes a security breach. We said, "No" to such requests. (#M3)

We really respond to user changes that are truly goal driven since we cannot claim to know it all. Regardless of what it will cost us, we immediately pick out the domain experts from our pool of experience designers that knew best about the problem. They come up with the script, test it and educate us about the security implications from a usage perspective. Then we implement it only on that user's space and monitor it. When we realized later that our users might need such a change or content we generalize it to all. (#M3)

As a software designer the most powerful of our modular REST Platform is the auto-update center. With it, we are highly responsive; users definitely appreciate when you can diagnose a problem while on the phone with them and then push out the fix just a few minutes later (#SD1)

The knowledge of certain aspects of the website was something I didn't have but when I ring them up I got a response immediately. You know these days, contacting an online vendor for support can be frustrating. But 22seven is a pleasure to deal with. I found their support team extremely knowledgeable in financial matters. They are creative in trying to identify solutions to my problem when I tried to build my self-audit dashboard on my iPad. I have a great deal of confidence in their abilities. (#U9)

Table 9: Chains of Evidence: System's misfits and ease-of-workarounds		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
I always have to adjust its contents to a finer detail before I could get what I want"#U12. We develop customizable built-in contents to a certain degree. It might not match users' needs quite right. But users can adapt the contents to meet their specific financial activities (#M2) Our website is designed for you to create financial service solutions in tandem with your financial behaviors. Our system can never match each individual needs, and I don't think any system can perfectly claim such. We provide the basic structural features and users complement us by building on it to customize their needs (#SD1). System misfits are usually experienced by our users, but I can assure you as a support staff that our users know how to get around it in their own ways. We noticed most of that moves in their individual activity logs on this console. Extreme cases exist where they call and we assist them. If the contents are not there we create it for them in the shortest possible time if functionally viable or necessary (#SD2) . I can easily workaround the system to fit my financial behavior. Now that I have some knowledge of its features, I create more tags to accommodate my spending habits without assistance. With 22seven, I have also tied my Nedbank savings account with my actual spendings so that I don't overspend. I created a grocery budget from that account for my wife this Christmas and whenever on shopping she opens it up and check how much money I budgeted for a certain area on her iPhone. I later configured it to alter her when we are like spending too much on groceries and children's wears for that month. With this, our financial prudence has tremendously increased and we now can save more. You know I can't get it elsewhere, like this. (#U13).	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ System's misfits and ease-of-workarounds	System's misfits and ease-of-workarounds
If you initiate two tasks at a time the website isn't gonna take it and it kicks you out of the system completely. So you end up starting afresh and initialize the system before coming in. Often it locks you up and you can't use it for some time because the stupid application won't take it and you have to call 22seven. (#U29) <u>My reconfiguring the website to be in tune with my cash-flows and spending habits is simple and is in tune with my personal lives. The menu is there for you to just do that, but often time it does not go my way in fine details and so I have to find my way to do it (#U27)</u>		

Table 10: Chains of Evidence: System's Affordances

Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
Service value creation affordances I had wonderful experiences with 22seven, but one always comes to my mind. <How? The researcher inquired>. I used 22seven to set a goal of buying a car and the tracking of my progress sometime last year. It got to a point I felt I can buy the car; I clicked 22seven car dealers' hyperlink and highlight my choice car and also I swing backward to experian.co.za to check my credit score. I booked my car loan at Nedbank after comparing interest rates with other sources with 22seven website. The next two days I got an email to visit any Nedbank branch nearest to me, which I also used the location widget of 22seven on my iPhone to locate. There, I signed off the necessary details and after a few days I got this car [the interviewee pointing to a sleek Toyota Auris Hybrid] (#U10). I used 22seven Pay Bill widget to split bills between my roommates across different internet banking websites. <How? The research inquired>. Each of my roommates sends their money from their respective banks to my e-wallet and I rolled the balances over to our Landlord's account monthly. (#U24) Visualization value affordances With the user model, I built a dynamic net-worth on my iPad. With the analytics tool, I drilled down to granular details. As at present, my net-worth connects directly to my financial transactions as in one place and it's always up to date. This reduces the potential for errors and I'm certain about its information for making investments and spending decisions. (#U27) Yes, 22seven assists me to watch my accounts across banks- found two "hideaway" debit orders below the R100 threshold running for 2 years, yet no notification from my bank. Also, banking fees are being watched like a hawk and will give me the opportunity to jump if cheaper accounts pop's up. Being able to see my net-worth slowly growing every day is also a positive counter.	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ System's Affordances	System's Affordances

One day I hope it's in the plus range. (#U25)

Pedagogical affordances

22seven provide us with information about the extent to which an individual can begin a savings or investment plans. For me, I usually engage their online financial expert in click-to-chat discussions on the best plan. I see the advice as valuable, non-bias and non-persuading though, there is a disclaimer in case of harm caused by using their advisement (#U26).

22seven gives me a lot of knowledge about personal finance. I started enjoying their investment and saving opportunity advice for some time before thinking about signing on with my bank or with Old Mutual, but I finally got Old Mutual to sign me up. (#U27)

Mobility affordances

He has an iPad strapped on the left arm of his wheelchair with his able left hand, he swipes across 22seven widgets while confined to his wheelchair. And through that adaptation he is able to interact with the technology and access his accounts. And when interviewed he stated "It brings an immediacy and personalization to banking activities which otherwise wasn't there. Unlike internet banking, I don't have to hop around each bank's website where my accounts are, I just get them from one source" (#U16).

When 22seven on iPad comes home it is just like a follow-up in the office, but with more relaxed and intimate interactions with my husband who understands investment matters. What we saw in the office can be followed on at home in a relaxed mood, which is really important (#U6).

I'm a contractor that knows little about investments. But when 22seven on my iPad comes home, my wife will show me investment plans, she 'LL point out some viable ones to me, show me how it works and at the end, I signed up with Old Mutual and I'm happy seeing how our investment grows (#U14).

I used it anywhere, anytime... (#U30)

...it makes me recognize the personal nature of my finances (#U8)

... allows me to customize it and gives the pedagogy that suit my learning aspirations in financial matters (#U21).

Table 11: Chains of Evidence: Personal innovativeness in IT (PIIT)

Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
No matter how good our technology is, as designers, we cannot predict how and for what our users will use them. The majority of our users is innovative who turn things around and we are here to assist them do just that with intuitive user interface. We cannot say we know better than anyone how our technology must be; we rely on their suggestions to innovate (#SD5) We cannot ignore the innovative potential of our users. If we insist on turning our backs to them, sooner or later someone will offer what they need and we are out of business (#SD4) I explored several information sources, on my own initiative, concerning the system. Which I find helpful, especially on my iPad (#U17) I do research on my own in order to increase my mastery of the system (#U22) I consider myself to be knowledgeable about the new financial website (#U23) I have learnt the technology and I have also come to discover that no matter how good a technology is, the designers cannot know it all, so I go my own way with their intuitive user interface (#U7).	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Personal innovativeness in IT (PIIT)	Personal innovativeness in IT (PIIT)

Table 12: Chains of Evidence: Technological cognizance		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
I didn't quite like the way the categorized spending was displayed on my Tablet. A withdrawal from an ATM shows up as uncategorized money without a clue of what I spent that money for. So I created a new row which I placed as ATM cash withdrawal transaction for every expense. With this, I manually input my ATM withdrawals with each of the items I used that money and display it in a format I can easily remember. Often time if they are much I create a .csv file and upload it into my user model. From there I can pick it up and add it to the ones automatically done by the system and display them on my Tablet. (#U9) The way I use 22seven to fetch my transactions from different bank accounts and embed them in another different media like my iPad graphics is amazing. I can sync to other devices and export my financial report to either .csv or .pdf in order to print copies of it. <The interviewer further asked. Don't you think it is because of your background as a web-designer? > Yeah, maybe! (#U7) Being a non-techie is not even a barrier. Acquaintance with 22seven.com is easy although it took some time before I can more or less use it very well. Even, I know which data formats to use in response to different needs. To build a good quality dashboard, I chose the right data formats by fiddling to understand its strengths and weakness. Then I take a choice on the right format that suits by iPad graphics. (#U23)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Technological cognizance	Technological cognizance

Table 13: Chains of Evidence: Technology mediation

Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
Encouraging customers to look at their long-term horizon and save is great for 22seven, but ultimately its investment advisement leads to one place: Old Mutual saving plans, mutual fund, and other products. As it offers savings that link these products they are likely to get paid whenever a new user opens an account. (#U20) Financial advisement of 22seven might be technically accurate, but it is difficult for one to uncover the interior motives or conflict of interest that is hidden in the nooks and crannies of the website. (#U27) I use the technology, but I'm cautious because the technology seems to compel me to believe the financial market as Old Mutual or the technology sees it. This can make me sign-up investments that may not be viable, which they will not even be responsible according to their disclaimer. (#U18) Relying on what the system does on your behalf is a problem. Trying here is even more dangerous because you might have lost some money if it backfires. There should be a way of reassuring the user that the information here is reliable and trustworthy, but what you see is a caveat reminding you that you are at your own risk if the advice given is taken (#U14) We need to be extremely cautious, otherwise, we go in the name of looking for cheaper mortgage rates and fall in the hand of non-performers, who merely used the website to lure us (#U27)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Technology mediation	Technology mediation

Table 14: Chains of Evidence: Trust-Distrust Dialectics: Bounded Trust

Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
I somewhat trust the website when I found that Old Mutual recently acquired 22seven which put me at ease, but I sparsely use it. <Why the researcher asked? >, because I felt that the site might be potentially dishonest having not been tested by the public. (#U19) Even if I trust 22seven, I'm cautious and afraid when I imagine that their security could be compromised. Um, that can happen, but I don't pray for that. You know I can't even help it when it does, then my whole banking details are exposed to online fraud, it is really scary. (#U25) I use 22seven at least once per month to have a total view of my business and savings accounts collated from different banks. I find this feature extremely important for my personal budgeting. However, when it comes to some investment advisement, securities in particular, I do not trust them. Often time it is belated and not accurate. Although, they claimed that the advisement is for informational and educational purposes only, and not for the furtherance of investment commitment. (#U15) Based on my experience, 22seven has put forth some major benefits, no doubt about it. But its vulnerabilities are still serious issues. That's why my colleagues are still delaying signing-on. One of them once told me that I'm being used as a "guinea-pig". But my confidence lies in Old Mutual that owns 22seven. (#U4) I am a bit apprehensive about adopting 22seven due to privacy and security reasons. However, the takeover of 22seven by Old Mutual is reassuring. I am considering going back to sign on since I quitted (#U12)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Trust-Distrust Dialectics: Bounded Trust	Trust-Distrust Dialectics: Bounded Trust

Table 15: Chains of Evidence: abnormalities and suspicion

Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
22seven is revolutionary with enticing benefits quite alright. But you see it is somehow strange and abnormal. It is completely new innovation, and since the banks initially opposed them, we have to exercise caution, wait and see how early users are faring before enlisting. (#U2) I'm skeptical about 22seven. It is new and has taken a completely different approach to online banking in SA. Although it looks like internet banking, but has different features and intent that seems not to be favored by some banks in SA so I'm presently learning how to use it. (#U14) I don't take 22seven investment plan at face value I check and verify everything they said. I asked for the breakdown of the financial product and hidden costs. I have to go out and see for myself whether what they said and are saying is true. (#U27) I suspect fraud intent as my bank hinted, but what is more worrisome is that, that same bank now patronizes 22seven, so I quickly understood that 'something fishy' is going on between the banks and 22seven, So I withdrew, still watching how all these things unfold (#U28) Presently, I tend not to trust the website. Still waiting to see how it unfolds to withstand hackers' prowl. <How? The researcher asked>, I'm waiting for my colleague in the office to tell me more about it. < Does your colleague use the 22seven? The researcher, further inquired> Yes, of course he is the "guinea-pig" for this technology as far as I know. (#U3)	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Abnormalities and suspicion	Abnormalities and suspicion

Table 16: Chains of Evidence: critiquing, reflection and learning		
Unit of Analysis: Paragraphs from the Dataset	Retroductive Inference (Researcher's theoretical memo)	Global Theme (Structure/Mechanism)
Before now we are busy fixing bugs, but that has waned. Presently we are refactoring some segments of the user library to align with their uses... however; any rationale for redesign must be articulated and justified. We can only do this by treating users' critiques, as a springboard to our iterative post-releases. You can no longer feel superior or arrogant when deploying this kind of system – the days of “build it and they will come” attitude has gone. (#SD3) Users' experiences as feedbacks can be reached through our user-collaboration strategy that is inherent in our XP design. Gently exploring and reflecting on why a user 'might need that feature or functions' we learned from the vital information garnered. We then used the knowledge to rescript our system for better interaction. (#SD2) Yeah. We constantly observe and learn from users' experiences and most time we engage our user group in talks during our evaluation. We found a few.... issues and that.... did not match the requirement changes we go through some iterations to make sure we implement them correctly. Our post-iterations are not to perfectly fit their tasks, but to extend the windows of flexibilities a little more in their user space. These things take IT resources so we don't just generalize it to all users except on rare occasions. We treat each user separately within his/her user space and grow the functions in line with their usage skills in the technology. (#M3) We have noticed that after the launch of our website, there have been increases in ad hoc team assignment of designers to address users changing needs. Thanks to our management structure that can handle such an arrangement. (#M2) My experiences with 22seven have made me trust the website more after a series of haggling with my colleagues about its trustworthiness. I came to this point after assessing its functionalities and the Old Mutual reputation behind	Probing Question (PQ) What must have been the case for these patterns in the data to be possible and why? Or What mechanism must exist in order for the observed action to have been taken? Answer to the PQ Critiquing, reflection and learning	Critiquing, reflection and learning

the brand. (#U3)

Really, I have developed mastering of the website by reflecting on my experiences. To be honest, most of my experiences came from tinkering on it with my iPhone. (#U12)

I have two accounts Nedbank and HSBC. Before now I use to create my dashboard with Nedbank accounts only because of its automatic link with 22seven. Later, I came to understand that I can download my HSBC account statement in .csv format and upload them into my user model. That I did. I then created HSBC account tags and integrate it with Nedbank accounts to populate my user model and from there I built my dashboard that shows my complete accounts. (#U19)

We develop patches, which is a quick fix to confront user requirement changes. We send it to the user in his/her space right there and then without him/her notice. He/she suddenly realizes relevant improvement in task accomplishment in the technology

We cannot survive without iterative post-releases. It is the heart of our continuous improvement strategy. It is the engine on which we confront user requirement changes and the adaptive behavior of our web portal

Our last release was just two months ago, and it was a big one. We reworked our software to focus on minimal marketable features (MMFs). <What is MMFs the researcher asked? >. MMFs are a collection of users' innovative demands that make up major changes in our web portal. By focusing our releases on MMFs, we're hoping to improve the unanticipated uses of our site. We continue to improve incrementally as we learn from the users' feedback we gleaned from our weekly retrospective meetings on how our technology is performing out there

Most times we check the profiles of our users whose demand are far off, We surreptitiously make a local adaptation for that specific user and placed it in his/her "own library". The library is then linked to the icon widgets on his/her screen. We then monitor and see the usefulness of the local adaptation, we can then generalize it to all users in our next 'version' if necessary

We cannot survive without iterative post-releases. It is the heart of our continuous improvement strategy. It is the engine on which we confront user requirement changes and the adaptive behavior of our web portal3

Appendix E

