THE DESIGN AND EVALUATION OF AN INTERACTIVE ASSESSMENT INSTRUMENT TO IMPROVE THE FRONT END OF MOBILE SERVICE INNOVATION

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Declaration:

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Dedication

This thesis is dedicated to the memory of Pat and Johnny O'Neill and to Julia and Andrew Carey.

Acknowledgments

Table of Contents

List of Tables

List of Figures

List of Abbreviations

AHP: Analytic Hierarchy Process

CS1: Case Study One

CS2: Case Study Two

CS3: Case Study Three

CSF: Critical Success Factor

DSR: Design Science Research

DSS: Decision Support Systems

FEI: Front End of Innovation

FFE: Fuzzy Front End

HCI: Human Computer Interaction

HFE: Human Factors and Ergonomics

IDT: Innovation Diffusion Theory

IS: Information Systems

M-CAI: Mobile Concept Assessment Instrument

MNC: Multinational Organisation

NCD: New Concept Development

NPD: New Product Development

NSD: New Service Development

QCA: Qualitative Content Analysis

SME: Small and Medium Enterprises

SSI: Semi-Structured Interviews

TAM: Technology Acceptance Model

TPB: Theory of Planned Behaviour

TRA: Theory of Reasoned Action

UTAUT: Unified Theory of Acceptance and Use of Technology

UX: User Experience

Abstract

Mobile services have become vital in both business and avocation and the future of mobile telephony is expected to rely on mobile services. However, recent mobile service adoption trends contradict this statement as adoption is much slower than expected. One possible reason for this is the ineffective management of activities at the front end of the innovation process (FEI). For example, effectively managing the activities at the FEI can contribute to the overall success of a new product/service. This thesis explores the innovation process with a particular focus on the FEI in the context of mobile services. Several challenges at the front end of mobile service innovation are revealed. The objective of this research is to address these challenges and consequently improve the front end of mobile service innovation. The Design Science Research Methodology (DSRM) is followed to create an Interactive Assessment Instrument to facilitate decision makers with defining and evaluating mobile concepts at the FEI. This instrument is referred to as the Mobile Concept Assessment Instrument (M-CAI). The M-CAI is evaluated to understand what impact it had on the FEI. This involved implementing the M-CAI in the innovation process of three real-world organisations to capture the overall 'change' in the organisations innovation process as a result of its use. The main changes to the process for mobile service innovation recorded in this thesis are: 1) changes in the exchange of key information which resulted in improved communication, 2) changes to the structure of the activities in the innovation process which resulted in the activities and roles becoming more transparent. Finally, 3) concept definition and evaluation activities at the FEI were simplified which resulted in improvements to the decision makers understanding of key decision elements and consequently decision making in the mobile service innovation process.

Publication List

Peer Reviewed Journals

Carey, K, Helfert, M and FitzPatrick, D. 2014. "Examining Mobile Tasks and Devices: Developing a User Centric Guideline." International Journal of Mobile Human Computer Interaction, (IJMHCI) 6, no. 1 pp37-53.

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Carey, K, and Helfert, M. 2016. "Improving the Front End of Innovation: The Case of Mobile Commerce Services." International Conference on HCI in Business, Government and Organizations. Springer International Publishing.

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Chapter 1: Introduction

This chapter provides an overview of the thesis and the background to the research. It outlines the research problem and the motivation for carrying out this work. The overall objective of the research and the main research questions are outlined. The chapter concludes by summarising the research process and the overall structure of the thesis.

1.1 Research Background and Overview of the Thesis

The innovation process is crucial to the development of products and services. The thesis explores the innovation process, with a particular focus on the 'front end' commonly referred to as 'the front end of innovation' (FEI) (Koen et.al 2001). The FEI is examined in the context of mobile services. Several challenges with the front end of mobile service innovation are revealed. For example, literatures in this domain suggest that high failure rates in new product/service development are due to the deficiencies in efficiently and effectively managing the front end activities in the innovation process (Postma et al. 2012; Sætre 2012; Poskela and Martinsuo 2009; Cooper 2011; Ho et al. 2011; Verworn et al. 2008). The ineffective running of these activities has led to difficulties such as managers becoming committed to failing projects (Behrens and Ernst 2014; Cooper 2001; Balachandra 1984; Schmidt and Calantone 1998). As a result the core objective of this research is to improve the front end of mobile service innovation.

The Design Science Research Methodology (DSRM) is followed to create a solution which can improve the front end of mobile service innovation. Design Science Research (DSR) focuses on IT artefacts and their process of construction, implementation and evaluation (Peffers 2007). The IT artefact often acts as a vehicle towards theory generation or discovery and aims to provide insight to a problem area (Hevner et al. 2004). Therefore DSR involves 'building to learn' in contrast to software engineering methods where one 'learns to build'. Based on this logic an Interactive Assessment Instrument (IT artefact) is created to facilitate decision makers with defining and evaluating mobile concepts. This instrument is hereafter referred to as the Mobile Concept Assessment Instrument (M-CAI). The M-CAI's use is then evaluated to understand what impact it had on the FEI (e.g. insight generated which changed the FEI activities).

To evaluate the M-CAI's impact a multiple case study evaluation approach is applied (Yin 2013). This involves implementing the M-CAI in the innovation process of three real-world organisations to capture the overall 'change' in the organisations innovation process as a result of its implementation and use.

The main insights and changes to the mobile service innovation process traced in this research are as follows:

- Changing the exchange of information in a positive way by modelling important parameters of the decision which encourage decision makers to discuss key decision elements in a more collective manner (Desanctis and Gallupe 1987) resulted in improved communication in the innovation process.

- Structuring the decision making activities in the innovation process by logically re-arranging decision elements so they can be quantified adds structure to the process and makes the decision making activities more transparent (Cabantous et al. 2010; Callon 1998; Callon and Muniesa 2005). This resulted in activities and roles in the innovation process becoming more transparent.

- It was also recognised that modelling the decision situation simplifies decision making by enabling the decision maker to filter relevant information for their decision (Cabantous et al. 2010; Callon 1998; MacKenzie 2006). This resulted in improvements to the decision makers understanding of key decision elements in the innovation process.

It was found that the 'organisational sector' will impact the applicability of the M-CAI and consequently the above mentioned outcomes. For example, the M-CAI was suitable for private organisations and was deemed less applicable for public organisations.

It was also found that the 'structure of the innovation process' impacts the applicability of the M-CAI and therefore the outcomes. The M-CAI was found to be suitable for organisations with 'informal' or 'semi-structured' innovation processes and has less of an impact in organisations with rigid or structured innovation processes.

Therefore, the implementation of the M-CAI structures the more flexible process of private organisations while allowing them the creative space necessary to develop their mobile concepts.

1.2 Problem Identification and Motivation

Mobile services have become vital in both business and avocation (Nikou and Mezzi 2013; Carlsson et al. 2012; Gao et al. 2011). The future of mobile telephony is expected to rely on mobile services (Carlsson et al. 2012). However, the adoption of new mobile services contradicts this as it has been much slower than expected (Carlsson et al. 2012; Nikou and Mezzi 2013; Gao et al. 2011). This sparked the initial research motivation as the researcher wanted to understand why this is the case.

One reason suggested for this is the difficulty of managing the activities at the FEI. For example, the literatures imply that high failure rates in new product/service development are due to deficiencies in effectively and efficiently managing the front end activities in the innovation process (Postma et al. 2012; Sætre 2012; Poskela and Martinsuo 2009; Cooper 2011; Ho et al. 2011; Verworn et al. 2008).

The ineffective running of these activities has led to difficulties such as managers becoming committed to failing projects (Behrens and Ernst 2014; Schmidt and Calantone 1998). This often occurs as decisions are typically made on an ad hoc basis and ignore key information and therefore, inferior alternatives are selected (Hannola and Ovaska 2011; Gregory et al. 2012).

Effectively managing the activities at the FEI can contribute to the overall success of a new product/service (Alam 2006; Kim and Wilemon 2002). This poses difficulty as the front end is characterised by its ambiguous nature with a high degree of uncertainty and ill-defined processes. Furthermore, it has been described as highly dynamic, extremely error prone, fuzzy and troublesome (Akbar et al. 2013; Aagaard et al. 2011; Jörgensen et al. 2011).

To add to this the FEI is a vastly under researched area (Koen et al. 2014 Koen et al. 2001; Gregor and Hevner 2015). In particular the front end is hardly studied in connection with mobile service innovations (Bouwmann et al. 2008). Further research in this area will make a valuable contribution to the front end of mobile service innovation.

Key information is often overlooked if it is not exchanged effectively (Hannola and Ovaska 2011; Garvey 2014). This is difficult to achieve as:

"…information regarding service innovation is tacit, hardly formalized and hardly supported by relevant tools"

<div align="right">Bouwmann et al. (2008)</div>

This tacit and hardly formalised information can therefore impact the decision makers understanding and consequently decision making in the innovation process (Hannola and Ovaska 2011).

With a particular interest in mobile service innovations and the potential benefits they bring to society, for example healthcare, education, business, environment, etc., the above mentioned challenges need to be addressed to facilitate the creators of mobile services. Consequently, the lack of research combined with the above mentioned issues in the field of innovation management has motivated this work.

1.3 Research Objective

The objective of this research is to improve the front end of mobile service innovation and in particular front end decision making. As IT artefacts can be designed and used to generate insight for a problem area (Hevner et al. 2004) creating and implementing an IT artefact at the front end of mobile service innovation can provide the crucial insight necessary to improve decision making in the innovation process.

Cabantous et al. (2010) suggest material artefacts embody a rational conception of decision making and hence can act as 'rationality carriers' which diffuse rationality throughout organisations. This implies that artefacts can be used in practice as a vehicle towards making rational decisions. Their perspective allows one to view the challenges at the front end. For example, lack of structure, poor communication and understanding as conditions which can be altered to facilitate rational decision making as opposed to previous decision making approaches which may ignore these factors and solely focus on 'optimising' choices/decisions (e.g. Keeney 1982; Turban et al. 2007; Niu et al. 2009).

This inspired this research as it suggests that an artefact can be created to assist decision making at the front end of innovation. Based on this concept this research creates the M-CAI to assist decision makers to make more informed decisions when defining and evaluating their mobile concepts. This in turn improves the front end of mobile service innovation.

1.4 Research Questions

The following research question provides a clear focus for this study. The underlining research problem is the ineffective management of the activities at the front end of innovation which results in high failure rates in new product/services (Postma et al. 2012; Sætre 2012; Poskela and Martinsuo 2009; Cooper 2011; Ho et al. 2011; Verworn et al. 2008). This leads to the research question:

"How Can The Front End Of Mobile Service Innovation Be Improved?"

This overarching question is broken down into three further research questions.

To understand the specific challenges at the front end of mobile service innovation and why they are occurring research question one, (RQ1), is posed:

1. **RQ1: What are the challenges at the front end of mobile service innovation?**
To address this, a detailed examination of the front end of mobile service innovation is conducted and the challenges are summarised in chapter three.

As this research sets out to address the recognised challenges at the front end of mobile service innovation research question two, (RQ2), is then posed:

2. RQ2: How can the challenges at the front end of mobile service innovation be addressed?

It is necessary to identify what is required to address these challenges, therefore theories and principles which help meet these requirements are examined. These theories and principles inform the creation of the IT artefact so that it can be designed to positively change the innovation process. This is described within chapter three and chapter four.

Once the IT artefact is created, its impact on the innovation process is then evaluated to determine if the challenges at the front end of mobile service innovation were addressed. This leads to research question three, (RQ3):

3. RQ3: How has the front end of mobile service innovation been altered, (changed/improved/unaffected), as a result of the research solution?

To address this question the M-CAI IT artefact is implemented in the innovation process to investigate its impact. This is described in chapter five and chapter six.

1.5 The Research Process and Structure of the Thesis

Each stage of the research process and the relevant chapter is illustrated in Figure 1.1. Chapter one documents the background of the research outlining a general review of literatures in developing the research focus and questions. Chapter two discusses the research paradigm, the research approach, the methods and techniques used throughout the research process and a justification for their selection.

Chapter three provides a detailed description of the research problem, the requirements to address the problem and the underlining theory to a solution. The problem is detailed based on an examination of relevant literatures and outcomes of interviews with experts from the IT services industry who describe the research problem from an organisational perspective. Requirements to address the problem are specified based on the outcomes of additional interviews conducted with industry experts. Also provided is the main literature summaries and underlining theories which support the creation of the research solution.

Chapter four describes the design, development and refinement of the M-CAI IT artefact that is used as a vehicle towards improving the front end of mobile service innovation. The design and development of the M-CAI involves literatures and expert opinions through the means of a number of techniques such as qualitative content analysis, (QCA), focus groups, analytical

hierarchy process, (AHP), questionnaire, scale and quantified adoption tables. The M-CAI is demonstrated to experts within a voluntary open-sourced mobile service development organisation and refined based on their feedback.

Chapter five details the M-CAI evaluation and its impact on the front end of mobile service innovation. It outlines evaluation propositions and profiles of the case study organisations and documents the three investigations. The investigations provide an account of the three real world organisations existing innovation practices and the implementation of the M-CAI within the organisations followed by interviews and observation data which is analysed using a thematic analysis technique to understand the impact the M-CAI on the front end of mobile service innovation within each of the cases.

Chapter six synthesises the cross case findings. The interpretations of the findings are summarised under the evaluation propositions. Themes which emerged from the data are included in this synthesis. Finally, cross case conclusions are drawn in addition to a discussion on the implications of the findings. This allows for an understanding of the impact of the M-CAI on the front end of mobile service innovation and the implications for future researchers and practitioners.

Chapter seven provides a summary and conclusion of the research outlining its main contributions, limitations and areas for further research.

Figure 1.1 Structure of the Thesis

Chapter 1: Introduction		
Problem Identification & Motivation	Research Objective	Research Questions

Chapter 2: The Research Approach	
Selecting the Research Paradigm	Selecting the Research Approach, Methods & Techniques

Chapter 3: Literature Examinations and Industry Interviews		
Problem Identification	Requirements Gathering	Identifying a Solution

Chapter 4: Design, Develoment and Refinement	
Design and Development	Demonstration & Refinement

Chapter 5: Evaluation	
Evaluation Propositions & Case Profiles	Three Real-World Case Study Investigations

Chapter 6: Cross Case Analysis and Findings		
Cross-Case Synthesis	Interpretations & Findings	Discussion

Chapter 7: Thesis Conclusion			
Contributions	Implications	Limitations	Future Work

Chapter 2: The Research Approach

This chapter presents a review of the principal philosophical paradigms and describes the one most fitting for this study. Design Science (DS) as the chosen research methodology is examined and the overall research approach is described. This includes the methods and techniques used at each stage of the process. Finally, the chapter outlines possible threats to the validity of the research findings and the tactics used to safeguard against them.

2.1 Selecting the Research Paradigm and Epistemological Approach

Differences in research perspectives are often characterised as a debate between two major and opposing world views or methodological paradigms. Benton and Craib (2010) state "there are two basic options - positivism or some form of interpretivism". A research philosophy contains important assumptions about the way in which one views the world (Saunders et al. 2011). The philosophy underpins the research strategy and makes a fundamental statement about the author's particular view of the relationship between knowledge and the process by which it is developed or generated. The Positivistic and Naturalistic/Interpretive perspectives are now compared.

Positivism known as the scientific approach usually begins with a hypothesis or theory to be disproved (Benton and Craib 2010). Naturalistic or Interpretive approaches differ at the outset as they typically start with immersion in a situation and allow themes to gradually become apparent (Bryman 2004). Positivist methodologies are associated with quantitative research, which generally focus on causal explanations. In this way theory precedes data, whereas in the interpretative approach theory follows data.

Some scholars combine the strengths of both paradigms. Steenhuis and Bruijn (2006) propose an approach that is aligned with the inductive paradigm using grounded theory principles to develop new theory through interpretations, but uses positivist validation techniques such as replication logic to check for similar concepts in subsequent cases.

Gregor (2006) argues that the type of theory under development influences the epistemological approach. She proposes a series of questions in relation to knowledge construction in the Information Systems (IS) discipline. These include the following:

- **Domain Questions**: What is of interest in the discipline?
- **Structural or Ontological Questions**: What is theory/reality? / What forms do contributions to the knowledge take?

- **Epistemological Questions**: How is theory constructed? / What research methods can be used?

These questions are now considered to establish what paradigm and epistemological approach best fits this research. Using Gregor's (2006) questions Table 2.1 summarises the characteristics of this study.

In relation to the first of Gregor's (2006) questions (e.g. what is of interest in the discipline?) this research is interested in improving the front-end of mobile service innovation. The overarching question set by this research is: "How can the front end of mobile service innovations be improved?"

In relation to the second question (e.g. what is theory/reality? / what forms do contributions to the knowledge take?) many realities exist in this study and are based on human experience including people's knowledge, views and interpretations. The contribution of this research is to improve an environment (e.g. the front end of mobile service innovation). Changes to the front end of the innovation process can be understood through the mental processes of interpretation that is influenced by user's experiences with the research solution.

In relation to the third question (e.g. how is theory constructed? / what research methods can be used?) this research focuses specifically on 'how' the innovation process can be improved and therefore aims to provide 'prescriptive' knowledge. Consequently, this is a prescriptive research study.

In her paper, Gregor (2006) also proposes a taxonomy of IS theory types. In this taxonomy she suggests 'prescriptive' IS research fits with the theory type known as 'design theory' as 'design theory' aims to provide prescriptive knowledge in the form of novel IT artefacts. Therefore design science as a research methodology is examined and presented in the next section showing its suitability for the present study.

Table 2.1 Characteristics of the Current Study

Feature	Description
Goals Of Research **(Domain Questions)**	- To improve the front end of the mobile service innovation process. - To understand and interpret the change to the front end of the innovation process as a result of implementing the research solution.
Ontology **(Ontological Questions)**	**Interpretivist**: There are multiple realities. - Reality can be explored and constructed through human interactions and meaningful actions. - Discover people's experiences with the research solution in the natural setting by means of daily routines, conversations and writings while interacting with others around them. - Many realities exist due to varying human experience, including people's knowledge, views, interpretations and experiences.
Epistemology **(Epistemological Questions)**	**Prescriptive:** Show how to improve the front end of mobile service innovation by providing a solution. - Events are understood through the mental processes of interpretation that is influenced by interaction with real world contexts. - Those active in the research process construct knowledge by experiencing the solution in their real life settings. - Inquirer and, the inquired-into are interlocked in an interactive process of talking and listening, reading and writing.

2.2 Design Science Research Methodology (DSRM)

DSR focuses on the IT artefact and its process of construction, implementation and evaluation. An IT artefact is often created to develop knowledge that can be used by practitioners to design solutions to their field problems (Van Aken and Ernst 2005). The IT artefact often acts as a vehicle towards theory generation or discovery. Therefore DSR involves 'building to learn' in contrast to software engineering where one 'learns to build'.

The DS community bases its conceptual roots on Simon's (1969) work on the Sciences of the Artificial. A good starting point to DS in IS research is provided by March and Smith (1995). They define it as an attempt to create things that serve human purposes in contrast to social sciences, which try to understand reality (Au 2001).

Rossi & Sein (2003) describe DS as a problem-solving paradigm with emphasis on the end products and the solution. DS is characterised by a system of principles, practices and procedures required to carry out a study. It aims to overcome research paradigms such as traditional descriptive and interpretive research in which the outputs are mostly explanatory

and often not applicable in practice (Peffers et al. 2007) and thereby intentionally removing the knowledge transfer issue.

Concerning research activities March and Smith (1995) identifies build and evaluate as the two main issues in DS. Build refers to the construction of constructs, models, methods and artefacts. Evaluate refers to the development of criteria and the assessment of the output's performance against those criteria. March and Smith (1995) add natural and social science, theorise and justify. This refers to the construction of theories that explain how or why something happens. IT and IS research is often an explanation of how or why an artefact works within its environment. Justify refers to theory proving that requires the gathering of scientific evidence that supports or refutes the theory (March and Smith 1995).

DS captured in the 'build and evaluate' cycle has become well recognised by the IS community (March and Smith 1995; Henver et al. 2004). Henver et al. (2004) use the framework proposed by March and Smith (1995) to produce guidelines to understand, execute and evaluate IS research. The framework includes the perceived business needs and the knowledge base on one side and existing methodologies and foundations on the other side. In their framework the knowledge base can be applied to design artefacts (constructs, model, methods, and instantiations) and can be then used to contribute new insights (Hevner et al. 2004). Therefore, the instantiation of designed artefacts will influence and change the environment in which it is implemented (Henver et al. 2004).

Researchers both inside and outside the IS discipline have sought to provide some guidance in defining and applying DSR (Hevner et al. 2004). However, despite several guidelines the literature has not explicitly focused on the design, development and evaluation steps of DSR (Peffers et al. 2007). Offerman et al. (2009) suggests that this step is a creative engineering process, and not much guidance is provided in IS literature.

Over the years, many researchers in IS and other disciplines have contributed ideas for process elements for DSR (Archer 1984; Eeekels and Roozenburg 1991; Preston and Mehandjiev 2004; Takeda et al. 1990; Rossi and Sein 2003; Walls et al. 1992). It is based on these seven papers, that the components of the DSRM were synthesised (Peffers et al. 2007). The result of the synthesis was a process model consisting of six steps in a nominal sequence, which is referred to as the DSRM. These six DSRM steps are outlined in Table 2.2.

Table 2.2 The Six DSRM Steps (Peffers et al. 2007)

Step	Objective	Description
Step 1	Problem identification and motivation	Defining the specific research problem and justifying the value of a solution.
Step 2	Defining the objectives for a solution	Inferring the objectives of a solution from the problem definition and knowledge of what is possible.
Step 3	Design and Development	The creation of the artefact and such as constructs models, methods or instantiations. Peffers et al. (2007) suggest an artefact can be any object in which a research contribution is embedded in the design.
Step 4	Demonstration	The use of the artefact to solve one or more instances of the problem. This involves its use in experimentation, simulation, case study, proof or other appropriate activity.
Step 5	Evaluation	Measuring how well the artefact supports a solution to the problem. The objectives of the solution are compared to the observed results after implementation of the artefact.
Step 6	Communication	Communicating the problem and its importance, the artefact its utility and novelty, the rigor of its design and its effectiveness, to researchers and other relevant audiences such as practicing professionals. This is done through scholarly research publications.

The next sub-section examines the suitability of the DSRM for this current study.

The DSRM is deemed suitable for this research as it fits to the interpretivist paradigm and is suitable for providing prescriptive knowledge, (e.g. design theory). This is as human involvement is ingrained in the design of the artefact, (e.g. M-CAI) and human experiences with using the artefact are captured in the evaluation.

Furthermore, the impact of the artefact on the front end of mobile service innovation will vary from organisation to organisation as there is no set 'innovation practice' in place therefore each organisation's innovation activities and actors are expected to vary. Consequently the impact on the front end of innovation is also unique to the individuals at each organisation and its applicability may vary depending on its context. Consequently the DSRM fits to the Interpretivist paradigm and is compatible with the characteristics of this study (see Table 2.1).

In addition, Peffers et al. (2007) approach is suitable for early DS researches as it provides a step-by step approach for conducting DS research. Furthermore, the DSRM has become a commonly accepted methodological guideline for effective DSR and therefore is fitting as the overarching methodology for this thesis.

2.3 The Research Approach and Methodology Roadmap

The DSRM proposed by Peffers et al. (2007) has been adapted to create the overall research approach adopted by this study. This research approach is depicted in Figure 2.1 and includes the main stages of the research and the methods and techniques applied during each stage. This is linked to the related chapters in this thesis. Each stage of the approach is now described under the following subsections.

2.3.1 Stage 1: Problem Identification

The input for this stage comes from both a review of relevant literatures and interviews with industry experts. The focus of the literature review and expert interviews were framed by RQ1: What are the challenges at the front end of mobile service innovation?

Examining the Literature: The examination of literature contributions across several fields such as: Mobile Computing, Mobile Service Innovations, Innovation Management, Service Management, Product and Service Innovation, New Product Development, (NPD) and New Service Development, (NSD) was conducted with a particular focus on contributions in Innovation Management. Traditional literature reviewing skills of further investigating emerging authors, publications and references permitted an in-depth analysis of key areas of interest to this study (e.g. FEI). Research on service innovation and NSD is examined and summarised along with state of the art literature in these areas. As recent research in this area focuses on the FEI and links the success of new services to the front end activities, literatures on the FEI are also examined and key challenges identified. For example, the difficulties of managing 'front end' activities in the innovation process are outlined. The examination of the literature in these areas resulted in the exposure of literature gaps which are addressed by this study.

Figure 2.1The Research Approach
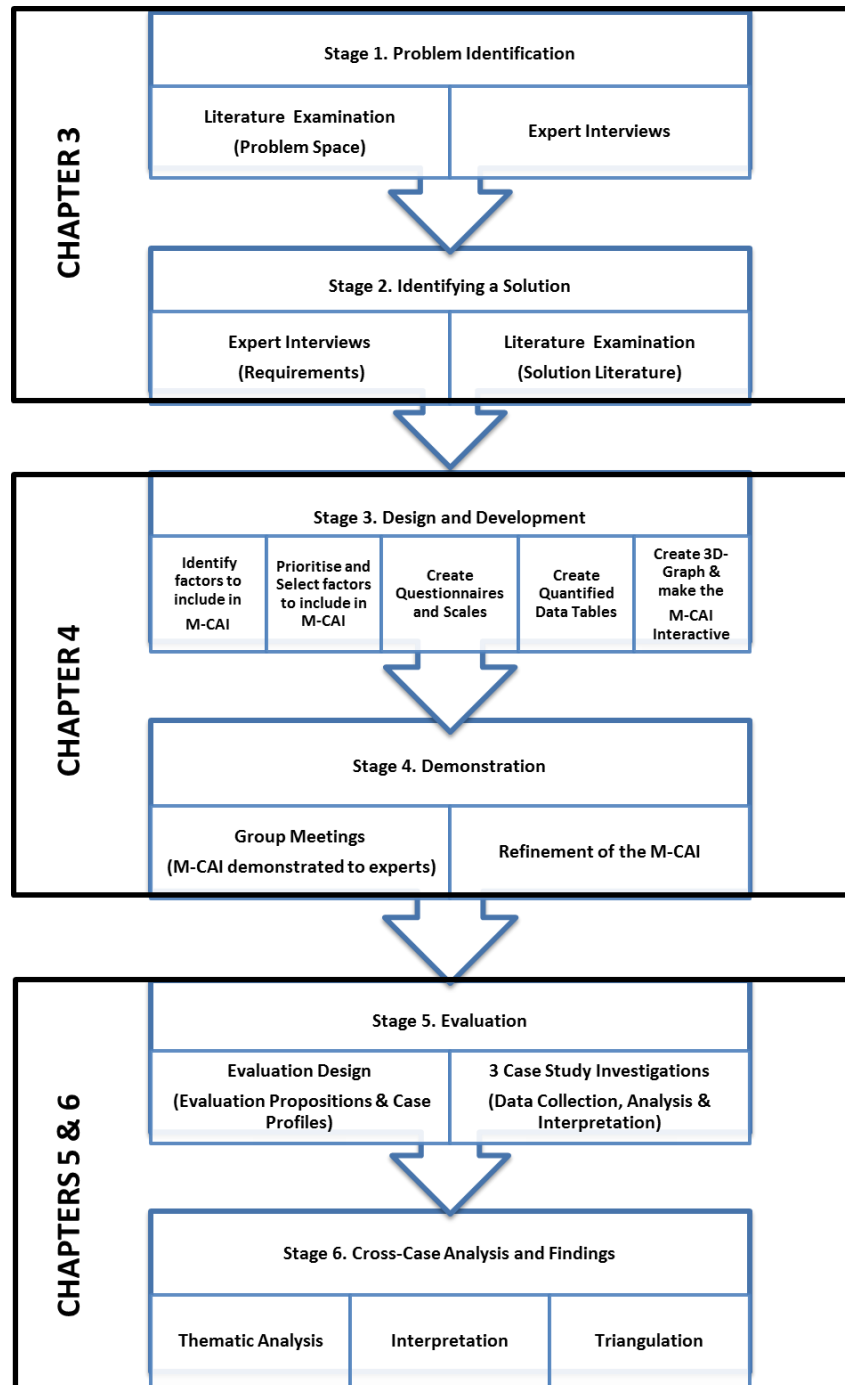
Expert Interviews: To understand the challenges recognised in the literature from an organisational perspective, a series of group meetings and interviews were held with industry experts over the initial months of the research project. A total of 17 industry experts from 2 Large Multinational Corporations (MNCs) and 3 Small and Medium Enterprises (SMEs) participated. These participants are classified in Table 2.3 in terms of the type of organisation they work for and their profession. All participants had experience with mobile application creation and/or IT innovation management. Individual interviews were conducted only with

the project managers and the remaining participants were interviewed as a group during initial group meetings.

Table 2.3 Expert Interview Participants

Organisation	Participants
Large IT MNC	Project Manager; HCI/UX Designer; Software Engineer
Large IT MNC	Project Manager; Designer; (2) Software Engineers
Medium Sized IT Enterprise	Project manager; Software Engineer; Designer
Small IT Enterprise	Project manager; Software Engineer; Designer
Small IT Enterprise	Project manager; Business Analyst; Software Engineer; Designer

The project managers at each organisation were contacted to schedule group meetings with the mobile application development team. As this was the early stages of the research project informal meetings were arranged where the research problem was openly discussed and field notes recorded. In some cases follow up meetings were arranged exclusively with the project managers to discuss key points and further clarify specific questions. The discussions were steered by an unstructured interview guide framed by RQ1. This encouraged participants to share information on, 1) the description of their organisations current innovation process, for example, if it is formal (structured) or informal (unstructured), 2) the front end activities they engaged in and 3) challenges with the front end activities, e.g. common errors found in the process. Interpretations of these interviews were compared to the findings from the literature review to recognise similarities.

The outcomes of this stage are detailed in chapter three. This helped to describe the front end of mobile service innovation as well as identify its challenges and areas for improvement.

2.3.2 Stage 2: Identifying a Solution

The second stage involves identifying a suitable solution to the problem and specifying (framing) the objectives of this solution. The input for this stage comes from additional interviews with the same participants from the previous stage and an additional examination of literatures to help inform the solution. The interviews and literature examination were guided using RQ2: How can the challenges at the front end of mobile service innovation be addressed?

Expert Interviews: The unstructured interview guide encouraged the participants to share information on the requirements necessary to address the challenges at the front end of mobile service innovation. All data gathered was recorded in field notes and manually examined and interpreted. The requirements were gathered and summarised under: 1) the requirements for the front end of mobile service innovation and 2) the practical requirements.

Examining the Literature: Several fields of literature were examined, including: decision analysis, decision making, process structuring and information exchange literatures (Weihrich and Koontz 1993; Cabantous et al. 2010; Clemen and Reilly 2013; Porter 1996; MacKenzie 2006; Callon 1998). These were examined as insight in these areas can shed light on a solution to the decision making challenges at the front end of innovation. Cabantous et al. (2010) imply that artefacts can be used (in practice) as a vehicle towards making rational decisions. Based on this concept, this research creates an IT artefact in the form of an interactive assessment instrument - known as the M-CAI - to assist decision making at the front end of mobile service innovation. To frame the objectives of the M-CAI the literature was further examined to investigate what was possible for the M-CAI to accomplish and to provide a good user experience.

The outcomes of this stage are detailed in chapter three.

2.3.3 Stage 3: Design and Development of the M-CAI

The next stage of the research involves creating the M-CAI. This stage has been broken down into five steps:

1) Identifying Factors for Inclusion in the M-CAI

To identify the key elements the researcher conducted a QCA and a Focus Group with Industry Experts.

Qualitative Content Analysis: A QCA is defined as the subjective interpretation of text data through the systematic classification process of coding and identifying patterns (Krippendorff 2012). The aim of the QCA is to derive a general list of adoption factors following the inductive approach (Elo and Kyngäs 2008). This resulted in two taxonomies of adoption factors present in the knowledge base for possible inclusion in the assessment instrument. Firstly the objectives of the QCA were specified and the units for analysis selected. Directed by these objectives the researcher then started to search the literature. It would be impossible to include all literature contributions consequently a practical screen was conducted to restrict the total number of articles considered so that the QCA is

practically manageable. For example, only articles published from the year 2005 were considered due to the novelty of mobile service innovations and the rapidly changing environment that makes older articles obsolete.

Following this a quality appraisal was conducted to score the quality of the articles included in the QCA. There is no exact definition of what it means for an article to be of sufficient quality. However, the following journal rating charts were consulted: the AIS Basket of eight, the MIS Journal Rating and the National Journal Rating Consolidated TIER. Within the IS field, these are considered as some of the most dependable sources (Okoli et al. 2010). Over exclusion of presumably lower quality articles has led to problems for previous reviewers, consequently this research extended the sources for inclusion in the analysis to articles from the ACM Digital Library, Google Scholar, ProQuest and EBSCO online databases. In addition computing surveys represent a summary of many previous results and can be more influential than individual contributions. Consequently computing surveys were also included in the analysis.

At the end of the screening process all contributions selected for inclusion in the analysis were classified into a source database and transported into NVio, a qualitative data analysis software tool. Two taxonomies of factors were formed by coding and categorising the data (contributions) following the qualitative coding process proposed by Thomas (2003). This approach involves the detailed reading of raw data to create a model or taxonomy through interpretations of the data (Thomas 2003). This coding approach is suitable as the researcher is engaging in 'inductive analyses'. In addition the data coded are 'categorical units' (e.g. adoption factors) as opposed to 'themes' therefore Thomas's (2003) approach is more suitable than a thematic analysis technique.

When reading the contributions specific text segments were identified and assigned labels, (codes). For example, when a mobile service or context of use factor which influences adoption became apparent it was highlighted and allocated a code. Each code was assigned a definition to ensure consistency. In some cases, codes had additional sub-factors which were also qualitatively coded. This coding was executed for both mobile service and context of use factors that influence adoption. To reduce overlap the list of initial context of use and mobile service codes were then categorised. This involved renaming, merging, distilling and clustering related codes into broader categories. The definitions of any codes which appeared similar were compared, merged and, if necessary renamed or deleted. Following this, two taxonomies - a context of use taxonomy and a mobile service taxonomy - emerged.

Focus Group (A) with Industry Experts: The intention of the focus group was to refine the initial long list of codes in the taxonomies from an organisational perspective. The participants in the focus group included five mobile application development experts. These experts included a project manager, two software engineers, a user experience (UX) and HFE expert and a business analyst. All participants were employees of a large IT MNC with over 4500 employees in its Irish campus. Within the organisation the participants were members of a mobile application development team responsible for the creation of enterprise applications. The focus group was conducted on site at the organisation and the KJ method followed (Spool 2004). This resulted in the refined taxonomies. The refined taxonomies represent a more relevant set of mobile service and context of use factors that influence adoption.

2) Prioritising and Selecting Factors to Include in the M-CAI

To prioritise and select the factors to include in the M-CAI the researcher conducted an additional focus group and an AHP analysis with the wider community.

Focus Group (B) with Industry Experts: The second focus group reviewed the refined taxonomies formed in the first focus group meeting and prioritised the top twenty factors which should be included at the front end of innovation from an industry perspective. These were the same participants from the first focus group and this meeting was also conducted on site at the MNC's Irish Campus.

The participants selected the ten most relevant factors from each of the refined taxonomies. Ten from the mobile service taxonomy and the ten most relevant factors from the context of use taxonomy. This involved highlighting the factors they deemed most relevant to consider during the innovation process. Each participant ranked 1-10 the most important factors, (from their point of view), with 1 being the most important and 10 being the least important. The results were compared and adjustments made until the group reached a consensus on the top twenty factors for inclusion, (e.g. 10 from each taxonomy).

AHP Technique: It was then necessary to go to the wider community to prioritise these factors for inclusion in the M-CAI. This ensured factors selected came from an equal balance of participants. To do this the researcher used AHP technique. AHP is a structured technique for organising and analysing complex decisions, based on mathematics and psychology (Saaty 1989). A structured excel template for AHP analysis was sourced from the business performance management webpage (BPMSG 2012). Using the excel template two AHP exercises were created using the twenty adoption factors - one exercise for

prioritising and selecting mobile service factors, and the other for prioritising and selecting context of use factors. These AHP exercises, (spreadsheets in excel), were emailed to twenty participants to ensure that the factors were selected by the broader community. These twenty participants included the five participants from the two focus groups. The additional 15 participants included scholars (PhD students) familiar with innovation management and/or the mobile application development process and practitioners familiar with the development of mobile services. These participants were sourced in a 'snowball' manner. For example, the researcher was familiar with many of the participants as they were fellow PhD students in Dublin City University and practitioners she met at conferences. Some participants asked acquaintances to participate in the study until twenty participants were sourced.

The exercise emailed to the participants instructed them to allocate weights to each of the factors. They compared the factors and filled in the table by ranking the individual factors either 'A' or 'B' in order of importance, with 'A' being more important than 'B'. Then they graded the level of importance on a scale from 1-9. The participants systematically evaluated the factors for inclusion by comparing them to one another with respect to their impact on the element above them in the hierarchy. In making the comparisons, the participants used their expert judgments to decide which factors were the most relevant for inclusion in the M-CAI. The AHP spreadsheet converts these judgements to numerical values, which was processed and compared. A numerical weight was derived for each factor, thereby allowing them to be compared to one another in a rational and consistent manner. This step was performed by each of the participants until all twenty participants had allocated a weight of importance to both spreadsheet exercises. The factors with the highest weight of importance allocated by the participants were selected for inclusion in the M-CAI. Any factors that received below 5% of importance were excluded as based on the dispersion of weights, any factor below 5% would not have received a prioritised weight of importance (BPMSG 2012). This was completed for both exercises until a prioritised list of 1) mobile service factors and 2) context of use factors were selected.

3) Creating Questionnaires and Scales

The next step involved creating questionnaires and scales using a combination of both the selected factors (from the last stage) and existing (published) instruments. This involved the following:

Mobile Service 'Type' Categories: Categorises of 'types' of mobile services, (e.g. communication services, information services, etc.), were created so that mobile concepts could be characterised in terms of the types of services. Categorising mobile concepts in

terms of 'type' allows for the data to be filtered so only information relevant for that specific type of service is presented. The types of services are based on categories suggested by Nikou & Mezei (2013) and Nickerson et al. (2007).

Mobile Service Questionnaire and Scale: The selected mobile service factors were used to create a mobile service questionnaire and scale. This is a nominal scale as it allows one to categorise the specific mobile service characteristics which define the service. These scales range from 0-100%. A range of 0-100% visually emphasises the difference between categories. Using both questionnaires and scales the decision maker reads each question and allocates a score to the categories they feel best define their mobile concept. The decision makers categorise their mobile concept in terms of its characteristics/factors, (complexity, intuitiveness, etc.). Questions were created to represent each mobile service factor and the possible answers were structured on scales to represent the possible categories the mobile concept may fit to.

Context of Use Questionnaire and Scale: In a similar fashion, a context of use questionnaire and scale was created. The nominal scale was again deemed appropriate as this scale allows one to categorise the specific context of use characteristics which define the mobile services context. Decision makers categorise their mobile concept in terms of its context of use, (use situation, user base, etc.). Questions were created to represent each context of use factor and the possible answers were structured on scales to represent the possible categories to describe the context of use.

Mobile Adoption Questionnaire and Scale: Lastly the researcher examined the literature to identify an existing 'adoption' instrument, (Questionnaire and Scale). As the aim of the M-CAI is to quantify the likely adoption of mobile services, an existing adoption instrument (Gao et al. 2011) with a ratio scale ranging from 0-100% was applied where 0% represents little or low adoption and 100% represents high adoption. In particular, the adoption outcomes fit into three categories; low, moderate and high adoption (Gao et al. 2011). Low adoption is captured as any score under the threshold of 40%. Any score above 41% represents a moderate to high adoption and a score over 60% represents a high adoption rate. These categories were colour-coded to add more meaning to the data. Red indicates low adoption, dark green moderate adoption and bright green high adoption.

All the above formed the M-CAI and are used to quantify the adoption of existing mobile services.

4) Creating Quantified Adoption Tables

The questionnaire and scales were used to aggregate and quantify the adoption of existing mobile services. This quantified data was then structured in data tables which are stored in the backend of the M-CAI.

Aggregating the Adoption Data: Published studies, which record the adoption outcomes of numerous mobile services were used to allocate scores to the questionnaires and scales in the M-CAI. These are the studies gathered from the QCA which document the impact of specific factors on the adoption of mobile services. Scores to best categorise each specific study were subjectively allocated to the M-CAI. The data from each study was stored in the backend of the M-CAI.

Creating Quantified Adoption Tables: Next the aggregated data stored in the backend of the M-CAI was clustered into groups in terms of service 'type'. The average adoption was calculated for each group. For example, the adoption of all 'Information Services' whose mobile service and context of use characteristics fitted into the category 0-20% was grouped together and averaged. This was completed for each category (e.g. 0-20%, 21-40%, 41-60%, 61-80% and 81-100%, etc.) and for each type of service (e.g. information, communication, transaction, social media, etc.). This data was then separated into data tables for each type of service.

These data tables are stored at the backend of the M-CAI and were used to link the adoption data to the mobile service and context of use questionnaires and scales. For example, when the questionnaires are completed, the adoption score is taken from the relevant data table and is returned in a three dimensional (3D) graph beside the questionnaire.

5) Creating a 3D-Graph and Making The M-CAI Interactive

The last stage involved visually representing the quantified adoption data in a 3D Graph and ensuring that the adoption outcome in the graph would adjust depending on the scores allocated to the questionnaire. Firstly the 3D Graph was created using the data fields from the quantified adoption tables stored in excel. Secondly, a separate tab in the excel spreadsheet called '3D Graph Background' was created to link the questionnaire scores to the different data tables and the 3D Graph. These were linked using macro functions in excel. When linked the 3D graph was then arranged beside the questionnaire.

The application of these five steps to create the M-CAI is detailed in chapter four.

2.3.4 Stage 4: Demonstration

The development of the M-CAI was an iterative process and therefore went through several cycles of refinement. Refinement was based on expert feedback following the demonstration of the M-CAI.

Expert Feedback: The M-CAI was demonstrated to a number of experts at group meetings within a voluntary 'open-sourced' mobile service development organisation. The participants, (experts), consisted of both practitioners and scholars who have several years of experience creating innovative and sustainable mobile solutions. The objective of the voluntary organisation is to solve real-world problems faced by communities across Ireland by providing them with mobile solutions. The organisation holds regular meetings where the volunteers split into various teams and create new mobile service solutions. During these group meetings, the M-CAI was demonstrated to the volunteers (experts). These meetings notably shaped the M-CAI. Specifically, the experts reviewed the questions and categories and then made suggestions to refine the scales. This took place over a series of months, until the experts suggested that the final version of the M-CAI was fitting. All feedback provided by the experts was captured in field notes and was manually inspected and interpreted by the researcher. A summary of the main expert suggestions for refinement is outlined in chapter four.

2.3.5 Stage 5: Evaluation of the M-CAI

The next stage involved evaluating the impact of the M-CAI on the front end of the mobile service innovation process. To do this Yin's (2013) multiple case study evaluation approach was combined with Fereday and Muir-Cochrane (2008) approach for thematic analysis as these approaches fit with the 'interprestivist' nature of this research. Moreover, Yin's approach allows for replications to be claimed, while Fereday and Muir-Cochrane's approach guides the 'interpretative' analysis of qualitative data. The evaluation is broken down into two steps:

1) Defining and Designing the Evaluation

Defining and designing the evaluation involved: specifying the evaluation propositions, selecting and profiling the case studies and designing the data collection tools.

Evaluation Propositions: The evaluation propositions define what is being investigated. They are derived from RQ3 and the theory of crafting rational decisions in practice (Cabantous et al. 2010) which is the main theory ingrained in the design of the M-CAI. In

addition a rival explanation of the propositions is also outlined. This is examined with the intention of disproving it and strengthening the study outcomes.

Selecting and Profiling Cases: Purposeful sampling (Patton 1990) was deemed a suitable technique as this involves selecting cases as it is likely their findings will/will-not be replicated. Using this technique one can describe the case study findings in terms of the case study characteristics, (e.g. organisational size, sector, etc.). These case characteristics are outlined in chapter five where the cases are profiled. These are important as finding similarities or differences under these various conditions leads to generalisations. The evaluation includes three case study investigations. Two cases, with similar characteristics were selected with the objective of replicating the findings. A third 'contrast case' with different characteristics is included to investigate if the findings differ from the previous two cases.

Data Collection Tools: The data collection tools include the case study protocol and all tools used to collect: documentation, interview, observational and artefact printout data.

- The Case Study Protocol: This guides the researcher through the evaluation process and includes instructions to be followed throughout each case, (data collection instructions, data analysis instructions, time-frame, etc.).

- Documentation Database: Documentation data include white papers, administrative documents, business process documentations, (models and diagrams), service information, etc. To assist with collecting and storing this data a case study database was created.

- Interviews: Both informal and semi-structured interviews (SSI) were conducted during the evaluation. Informal interviews aim to capture background data such as the organisational actors, their roles, and a description of the organisation's existing innovation process. The SSIs (Schultze and Avital 2011; Myers and Newman 2007) help capture the participant's experience with the M-CAI and the alteration, (if any), to the innovation process. These are gathered when the M-CAI is implemented and used by the case study participants. The interview guide for the SSI was created using RQ3 and the evaluation propositions.

- Observations: These ranged from 'formal observations' to 'direct data collection activities'. Direct observations of M-CAI in use were recorded in field notes. Formal observations were also carried out. Templates of the M-CAI questionnaires were

created. The data for these templates was collected by observing the M-CAI in use. For example, the scores allocated were recorded for each question.

- Physical Artefact Printout Data: Although the M-CAI is directly and formally observed the artefact printout data acts as an additional source of evidence. Once the assessment is complete a printout of the assessment is collected as a source of evidence (3D graph information and category scores). By examining the printout it is possible to develop a broader perspective concerning the use of the M-CAI in the innovation process.

2) Preparing, Collecting and Analysing Data

The next stage of the evaluation involved preparing to collect, collecting and analysing the data.

Preparation: Prior to conducting the cases, preparation involved creating a database to store all evidence and creating a coding manual which can be used when analysing the data.

- Case Study Database: The case study database is a separate and orderly compilation of all the data collected from the case studies. The qualitative data analysis software tool, (NVivo), is used to store and analyse all data captured.

- Coding Manual: Fereday and Muir-Cochrane's (2008) approach involves the creation of a template to be applied as a means of organising the data for subsequent interpretation. This is referred to as a 'coding manual' and serves as the data management tool for organising segments of similar or related text to assist in interpretation.

Collecting the Data: Firstly, data was gathered to capture the case participant's background information and the organisations existing innovation activities. This data was captured using informal interviews and was stored in the case study database.

A twenty minute presentation demonstrating the use of the M-CAI was then given to the participants. After this the M-CAI was implemented and used in the innovation process of each of the organisations. Workshops were held so the researcher could observe the M-CAI being used by the participants as a group exercise. This involved observing the participants using the M-CAI to help define and evaluate their mobile concept.

This information was captured using: observations (field notes and template data). The field notes and template data recorded the participants reasoning when defining the mobile concept and were saved in the case study database. In addition SSI's were conducted with each of the participants. The SSI's capture the participant's experiences in the innovation process following the use of the M-CAI. These SSI's were recorded using a voice recorder and on average took between 30-35 minutes for each participant. The recordings were then transcribed and saved in the case study database. Finally, the physical artefact print out data was also collected. This data includes the scores allocated to each factor in the M-CAI and the corresponding 3D Graph with adoption information. All data captured throughout the process were transcribed and stored in the case study database for analysis.

Analysing the Data: An individual analysis was conducted for each of the cases following the thematic analysis technique proposed by Fereday and Muir-Cochrane (2008).
Firstly, this involved qualitative coding of the data (Thomas 2003). Codes mark passages in data for further analysis and represent facts, events, objects, actions and interactions that occurred in the innovation process. This involved line-by-line coding of all the data stored in the case study database until all codes were exhausted and no new codes could be found.

Secondly the codes were connected and patterns and themes in the data identified. The coding manual guided this categorisation process. The previous codes, (i.e. passages of text), were inspected, and grouped under the categories in the coding manual, based on their common properties. The categorisation process was guided by but not confined to these categories. Therefore, if a code did not fit into one of the categories in the coding manual a new category was created and the code assigned accordingly. Quotes from the transcribed data were referenced to explain the categories. This also helped to maintain a chain of evidence. When referencing quotes from the transcripts, labels were used to reference the source (S). For example, 'P' refers to the participant, FN refers to field notes, 'T' refers to template data, 'D' refers to documentation data, PO refers to the printout data and 'L' refers to the line in the table the quote is taken from. The categorisation continued until all similar codes were clustered and renamed and all related codes were broken down into 2nd, 3rd and even 4th order codes, to better understand the meanings embedded therein. This resulted in the main themes emerging.

Finally a further examination of the emergent themes was conducted and the data triangulated to confirm the findings. This is referred to as 'corroborating' or 'verifying' the themes. Inferences from the data are drawn which claim a particular set of data supports a particular theme. When similar findings were evident from three or more sources the data was deemed to be verified.

The evaluation and its outcomes are detailed in chapter five. The findings from all three cases were then grouped together and a cross case analysis conducted to identify the main themes present in the data. An overview of the approach to the cross case analysis is detailed in the following section.

2.3.6 Stage 6: Cross-Case Analysis and Findings

The final stage of the research includes the cross case analysis and conclusions. The findings and interpretations of each of the individual cases are synthesised and further interpreted. A matrix table was created to help find similarities and differences across the three cases. The table includes the main themes referenced across all three cases and the number of times each theme was referenced. The matrix table is divided into two groups: 'as a result of existing practices' and 'as a result of the M-CAI'. The first group record outcomes traced as a result of the organisation's existing practices. The second group record outcomes traced as a result of the M-CAI. Using the cross case findings under these groups, the evaluation propositions and the rival explanation are addressed to highlight the impact of the M-CAI on the front end. This resulted in the conclusion of the study and the main themes to explain the data. This is detailed in chapter six.

2.4 Threats to the Validity of the Findings

There are a number of threats to the validity of the research. These threats and the tactics used to safeguard against them are now outlined. This research is mainly 'qualitative' in nature, therefore the tactics used apply to the quality of qualitative research (Yin 2013).

2.4.1 Threats to the Validity of the Design of the M-CAI

The first threat is to the validity of the design of the M-CAI and the information it contains. To ensure that the information included in the M-CAI is valid and relevant a QCA, two focus groups and an AHP technique is conducted. The QCA includes multiple sources of data from various, (well rated), journals and online databases as well as computing surveys. Therefore, this can reduce the risk of omitting key factors from the M-CAI. From this QCA two taxonomies of factors are created. These are refined using a focus group to ensure that the factors are relevant from a practitioner perspective. A threat is that dominant characters may take over the discussion and skew the refinement of the taxonomies. To prevent this, the focus group is conducted following the KJ method (Spool 2004). To prioritise and select factors for inclusion the AHP technique is applied by the wider community of 20 participants. This will

help to strengthen the validity of the design as the factors are selected from multiple perspectives.

2.4.2 Threats to the Validity of the Evaluation of the M-CAI

The next threats are in relation to the validity of the evaluation findings. Firstly, to ensure that RQ3 is addressed, the researcher narrows down the aim of the evaluation. To do this evaluation propositions are outlined to define what is meant by a 'change/alteration' to the front end of mobile service innovation. Another threat is to the validity of the evaluation findings. To prevent this, data is triangulated. Multiple sources of evidence are gathered through the means of interviews, field notes and documentation data, (from multiple participants across three case studies), in a manner encouraging convergent lines of inquiry. When three or more sources reference a particular theme it is deemed to be valid. Finally, to determine whether the findings are 'generalisable' beyond the immediate cases included in this thesis replication logic is followed. When two or more cases have similar outcomes, replication can be claimed (Yin 2013).

2.4.3 Reliability of the Study

Reliability implies, if subsequent studies follow the same procedures and conduct the same study over again, they should arrive at the same findings and conclusions. To ensure the research is reliable a case study protocol was created, this outlines the case study procedures making sure these procedures are transparent. In addition the 'raw' data captured in this study are made as accessible as possible to the reader prior to interpretation and analysis. For example, quotes from the transcripts were cited during the data analysis and interpretation to maintain a chain of evidence. Finally a formal database of the case study data is created so that an external observer can inspect, question and re-interpret the data, if necessary. The database increases the reliability of the study as a clear chain of evidence is maintained. It also ensures the researcher and future investigators can review the data directly and are not limited to the written case study reports.

2.5 Ethical Considerations

Ethical approval was requested from the 'Research Ethics Committee (REC)' in Dublin City University. This research is conducted adhering to the "guidelines on best practice in research ethics" provided by the REC. The application for approval included: the notification form, a plain language statement, an informed consent form and all interview guides used during the study. Confidentiality is very important for those participating in this study. As a result, all information will be anonymous and no personal information is

documented, such as organisation name, employee names, ages, details, etc. All data gathered is written up in the form of disguised extracts, to ensure the privacy and confidentiality of all participants. Based on this application formal approval was granted.

2.6 Chapter Summary

This chapter presented a review the principal philosophical paradigms and described the one most fitting for this study. DSRM as the chosen research methodology was examined and the overall research approach described. This includes the methods and techniques used at each stage of the process. Finally, the chapter outlined the possible threats to the validity of the research findings and the tactics used to safeguard against them.

Chapter 3: Literature Examination and Industry Interviews

This chapter presents the outcomes of the first two stages of the research process presented in chapter two. Both of these stages involved literature examinations and interviews with industry experts. Firstly, an examination of literatures on service innovation, the innovation process and the front end of innovation is presented. Areas which lack investigation and key issues at the FEI are outlined. Following this an account of interviews with industry experts is outlined. They describe the innovation process in the context of mobile services and outline any challenges encountered with this process from an organisational perspective. Requirements for a solution to the identified challenges are then outlined based on additional interviews with the industry experts. Finally, a summary of the decision making literatures explored, to help inform a solution to the challenges, is outlined.

3.1 Stage 1 Problem Identification: Literature Examination

3.1.1 Innovation and Mobile Service Innovations

Firstly, service innovation literatures were investigated as this research is concerned with 'mobile service innovations'. Innovation in the services sectors comprises new services as well as significant changes in services or their production or delivery (Eurostat 1995; Xin et al. 2006; Miles 2005). For many years, service innovation has been considered as minimal or non-existent. Information and communication technology, (ICT), has driven service innovation by providing new information and communication services and by enabling innovation in other services. As a result, there has been a shift in thinking about service innovation over the years and research in service innovation has increased significantly in the past three decades (Alam 2006; Blazevic and Lievens 2004; Froehle et al. 2000; Johne and Storey 1998; Menor et al. 2002).

Research on service innovation stemmed largely from NPD and NSD literatures. For example, NPD research has made a substantial contribution to our understanding of the overall innovation process (Alam 2006; Xin et al. 2006). The unique characteristics of services differentiate services from products. However, the NPD literature makes the assumptions that the development process for both tangible products and services are the same. Therefore, many researchers believe these factors may also affect the innovation activities and practices of many service firms (Alam 2006; Fitzsimmions and Fitzsimmions 1999; Johne and Storey 1998). Although NPD process models are abundantly dealt with in the

literature, NSD literature only emerged in the 1990s. Papastathopoulou and Hultink (2012) summarise four NSD review articles published between 1998 and 2003. Following this, they provide state of the art NSD literature over the period 2003 to 2012 and found that half of these NSD articles were only published in the last ten years. They argue that early writings on NSD mainly focused on a narrow set of NSD topics such as Critical Success Factors, (CSFs), and the NSD process.

To support the NSD process, Fitzsimmons and Fitzsimmons (1999; 2011) develop the NSD Process model. They suggest ideas for new service innovations can originate from many sources such as: customers offering suggestions, frontline employees being trained to listen to customers concerns and/or customer databases can be mined for possible service extensions. Moreover, trends in customer demographics can suggest new services and new advances in technology. These ideas form the input to the 'design' stage of the NSD cycle.

In the design stage ideas are screened and winning design concepts are developed and feasibility tested. Concepts that pass this design hurdle are considered in the 'analysis' stage to determine their potential as part of a profitable business venture. After project authorisation, successful concepts move to the 'development' phase. Considerable time and money are expended in the design to create a new service product and process. This can be tested with appropriate personnel training and a successful marketing campaign. Finally, a proven new service is deployed and made available to customers. While the NSD model provides considerable insight into the activities involved in the creation of new services it does not detail the early innovative activities which take place in the FEI process, i.e. prior to the design stages.

Papastathopoulou and Hultink (2012) suggest the NSD area expanded into research topics such as customer involvement and the organisation of NSD. These include studies investigated in high tech service industries in Europe, through qualitative research designs, Papastathopoulou and Hultink (2012) suggest the NSD area expanded into research topics such as customer involvement and the organisation of NSD. In more recent times the focus of service innovation has moved onto 'organising for innovation and in particular to organising the FEI (Koen et al. 2014; Koen et al. 2001). The FEI process can feed into the later NSD or the NPD process (Koen et al. 2014; Koen et al. 2001; Alam 2006) therefore, creating an additional step prior to design and development. Before discussing the FEI, services and mobile services are defined.

According to Grönroos (2007) a service is defined as follows:

"… a process consisting of a series of more or less intangible activities that normally, but not necessarily take place in interaction between the customer and the service employees and or physical resources or goods or systems of the service provider, which are provided as solutions to customer problems".

Grönroos (2007)

Since the emergence of telecommunications, data networks, internet, and most recently mobile internet, services are becoming more virtual and are often referred to as electronic services. Van de Kar (2004) defines an electronic service as follows:

"An activity or series of activities of intangible nature that take place in interaction through an internet channel between customers and service employees or systems of the service provider, which are provided as solutions to customer problems, add value and create customer satisfaction".

Van de Kar (2004)

The major difference between electronic services and traditional services is the role people play in the service delivery process. An electronic service is delivered by a software program via computer hardware and communication networks rather than by humans. This has major implications for the service characteristics (Bouwman et al. 2008). Electronic services are information-intensive. Digital information plays a key role and is very easy to duplicate and transfer. The role of the customer is also different in the case of electronic services: customers play a more active role via self-service and electronic services are less personal.

Mobile services are a subset of electronic services offered via mobile and wireless networks and/or mobile applications. This assumes mobility on the part of the user of the services, the device or applications (Bouwman et al. 2008).

Mobile services have now become vital in both business and avocation (Nikou and Mezzi 2013; Carlsson et al. 2012; Gao et al. 2011). In fact, the future of mobile telephony is expected to rely on mobile services (Carlsson et al. 2012). Moreover, the use of mobile services will be an integral part of the revenues expected to be generated by third generation mobile telephony (Carlsson et al. 2012). Despite this, the adoption of new mobile services has been much slower than expected (Carlsson et al. 2012; Nikou and Mezzi 2013; Gao et al. 2011).

Several explanations have been suggested for the slow up-take of mobile services (Nikou and Mezzi 2013; Carlsson et al. 2012). One reason is the difficulty of managing the up-front activities in the innovation process (Carlsson et al. 2012). For example, high failure rates in

NPD and NSD have been found to be a result of the deficiencies in effectively and efficiently managing the front end activities in the innovation process (Postma et al. 2012; Sætre 2012; Poskela and Martinsuo 2009; Cooper 2011; Ho et al. 2011; Verworn et al. 2008). The Innovation Management literature has shown that improving the front end activities can directly contribute to the success of a product/service and can therefore substantially benefit the firm (Dahl and Moreau 2002; Reinertsen 1999; Alam 2006; Kim and Wilemon 2002). Despite this, there is a dearth of research on the FEI (Alam 2006; Koen et al. 2001; Koen et.al. 2014; Gregor and Hevner 2015). For these reasons the existing literatures on the innovation process and in particular the FEI are now further examined.

3.1.2 The Innovation Process and the Front-End of Innovation (FEI)

Koen et al. (2001) divide the innovation process into three parts: 1) the FEI, 2) the new product/process development process and 3) commercialisation. They define the FEI as all activities that come before the formal and well-structured design and development process.

Koen et al. (2001) propose a new concept development model, (NCD), which they argue fits to the 'front end'. The NCD model suggests that ideas flow and iterate between all activities at the front end. In contrast, the development and commercialisation steps are a series of sequential, well-structured and ordered steps. The development phase involves more clearly defined design, development and testing activities (Koen et al. 2001; Koen et al. 2014; Karhu 2007; Alam 2006) and commercialisation involves clearly defined and well-structured production, deployment, marketing, sales and distribution activities (Karhu, 2007; Koen et al. 2014).

The FEI is a critical component of the innovation process. Choices made at the front end will ultimately determine which innovation options can be considered for development and commercialisation (Koen et al. 2014). In addition, these activities are critical as they lay down the foundations for the NSD process (Alam 2006). Many researchers have suggested that a firm should manage and optimise the front end to boost the chances of developing successful innovations (Koen et al. 2014; Alam 2006; Dahl and Moreau 2002; Khurana and Rosenthal 1997; Montoya-Weis and O'Driscoll 2000; Reinersten 1999). To improve the organisations' innovation activities the FEI offers the greatest potential with the least effort (Stevens 2014; Hannola et al. 2011; Aagaard et al. 2011). Problems that occur in the front-end - if not resolved- will flow into the later stages and therefore, the problems grow, together with the effort required to address them. As a result Reid (2004) suggests the FEI is the root of success.

In contrast to other stages in innovation for example, design, development, and commercialisation, the FEI was little studied despite its importance (Alam 2006; Koen et al. 2014; Koen et al. 2001; Gregor and Hevner 2015). Koen et al. (2014) suggests this is a vastly under examined area as only eight empirical publications (Bacon et al. 1994; Moenaert et al. 1995; Khurana and Rosenthal 1998; Langerak et al. 2004; Verworn et al. 2008; Verworn 2009; Poskela and Martinsuo 2009; Martinsuo and Poskela 2011) link specific activities at the front end to the outcomes of the project or overall innovation success.

Khurana and Rosenthal (1998) published the first comprehensive study of the FEI, based on case studies of 10 incremental and 2 radical projects. They argue successful organisations follow a holistic approach, one that addresses the front end within a broader organisational context and whose success depends on both organisational attributes and project specific activities.

In addition to the lack of research Koen et al. (2014) suggest the outcomes of these studies are limited. Some of these studies combined the results of both radical and incremental projects, yet Lynn, Morone and Paulson (1996) and O'Connor and DeMartino (2006) suggest the processes and procedures required for successful radical innovation are significantly different from theories for incremental projects, thereby limiting the applicability of their outcomes. Furthermore, they suggest all studies, with the exception of Khurana and Rosenthal (1998) rely on data collected from single respondents which is less desirable than multi-respondent data (Koen et al. 2014). Having outlined the limitations of these existing studies Koen et al. (2014) stress the need for further research at the FEI as existing studies that aim to shed light on the FEI are slim.

Extending on the work of Khurana and Rosenthal (1998), Koen et al. (2001) creates a holistic framework called the NCD Model for the front end. Their work introduces the phrase FEI which previously was referred to as 'the fuzzy front end', (FFE), by Reinertsen (1985). The word 'fuzzy' implies front end activities are ill-defined, of an ad hoc nature, lack accountability and cannot be managed (Reinertsen 1985). Many scholars have aimed to structure and define the front-end activities. The vast majority use a sequential approach where the front end is defined as a process with different phases (Burkart 1994; Reinertsen 1994; Cooper 1997; Khurana and Rosenthal 1997; Khurana and Rosenthal 1998; Reinertsen, 1999). In contrast Koen et al. (2014) describe the front-end activities as non-sequential and suggest this process can be managed.

Koen et al.'s 2001 NCD model divides the front end into three distinct areas: 1) the engine, 2) the wheel and 3) the rim. The engine (the centre of the model) represents senior and

executive-level management who provide power to the FEI. The wheel (the inner part of the model) comprises of five front end activities: opportunity identification, opportunity analysis, idea generation, idea selection and concept development. The rim includes the environmental factors which influence the engine and shape the five activity elements. These include the company's organisational capabilities, competitor threats, company resources, market trends and consumer/ user perceptions, etc. In contrast to traditional stage-gate processes, this model is circular in order to indicate how ideas flow, circulate and iterate across and among all five elements. The arrows pointing inwards to the model represent the projects starting points and indicate they may begin in either opportunity identification or idea generation. Projects leave by entering into the development stages.

With support from the national science foundation Koen et al. (2014) used the NCD model as a lens to identify the most effective practices in managing the FEI. To date, this is one of the largest studies to focus on the FEI. Their work identifies the organisational attributes and innovation activities necessary for front end success. Particularly Koen et al. (2014) suggest that the 'opportunity identification and analyses', 'idea enrichment' and 'concept development' were found to be the most important activity elements for front-end success. All front-end activities laid out by Koen et al. (2001; 2014) are now discussed.

Opportunity Identification: Here the organisation by design or default identifies the opportunities the company might want to pursue. Business and technological opportunities are explicitly considered so resources will be allocated to new areas of market growth and/or operating effectiveness and efficiency. This element is typically driven by the goals of the business. The opportunity can be an entirely new direction for the business or a minor upgrade to an existing service. The sources and methods used to identify opportunities are the essence of this element. A formal opportunity identification process may be aligned with all the influencing factors. Creativity tools and techniques, for example, brainstorming, mind mapping and lateral thinking as well as problem solving techniques such as causal analysis, Fishbone diagrams, process mapping, and theory of constraints may be utilised. Alternatively, informal opportunity identification activities may occur, which include ad-hoc sessions, individual insights, or edicts from senior management.

Opportunity Analysis: Additional information is needed for translating opportunity identification into specific business and technology opportunities and making early and often uncertain technology and market assessments. Extensive effort may be committed for focus groups, market studies and/or scientific experiments. However, the amount of effort expended is dependent upon 1) the attractiveness of the opportunity, 2) the size of the future development effort, 3) the fit with the business strategy and culture, and 4) the risk tolerance

of the decision makers. This element may either be part of a formal process or be occurring iteratively in reaction to opportunities identified, such as "what-if" scenarios.

Idea Generation: This represents an evolutionary process in which ideas are built upon, torn down, combined, reshaped and modified. The idea may go through several iterations as it is examined. Direct contact with customers/users and linkages with other cross-functional teams, in addition to collaboration with other companies and institutions often enhance this activity. Idea generation may be a formal process, including brainstorming sessions and idea banks so as to provoke the organisation into generating new or modified ideas for the identified opportunity. A new idea may also emerge outside the bounds of any formal process - a supplier offering a new material, or a user making an unusual request. Idea generation may feed into opportunity identification, demonstrating that the NCD elements may proceed in a non-linear fashion - advancing and nurturing ideas and opportunities wherever they occur. The output of this element is typically a more completely developed description of the "sensed" idea.

Idea Selection: In most businesses there are many ideas that the critical activity is to choose which ideas to pursue in order to achieve the most business value. Selection may be as simple as an individual's choice among many self-generated options or as formalised as a prescribed portfolio method. More formalised project selection and resource allocation at the FEI is difficult due to the limited information and understanding at this point. Definition of the financial return at the FEI is at best, often just a 'wild' guess.

Concept Development: This involves the development of a business case based on estimates of market potential, customer needs, investment requirements, competitor assessments, technology unknowns, and overall project risk. The level of formality of the business case varies according to the nature of the opportunity, level of resources, organisational requirements to proceed to development and the business culture. 'Concept Development' usually involves defining and selecting/evaluating this concept. This research describes concept development as two separate activities and refers to them as '**Concept Definition**' (Koen et al. 2014; Braet and Verhaert 2007) and '**Concept Evaluation'** (Braet and Verhaert 2007). Concept Definition largely involves specifying and defining key aspects of the concept to form the business case. This includes ensuring the concept and all its aspects are clearly defined and once defined the concept can then be evaluated. Concept Evaluation is the final 'go-no/go' decision point prior to moving into the design and development stage. At this point the results of the defined concept (business) case are evaluated. Here the go-no/go decision is a critical one as past this point it becomes increasingly difficult and expensive to turn back. This decision requires the collection and

consideration of information and the application of criteria against which this information can be assessed. Many factors are taken into account such as technology capabilities, customer perceptions, market factors, resources, company fit and capabilities and company limits. Based on this evaluation the go-no/go decision is taken. If the decision is to continue the project, moves into the next stage, otherwise the project returns to the concept definition stage to be refined or terminated.

3.1.3 Challenges at the Front End of Mobile Service Innovation recognised from the Literature Examination

Having reviewed innovation management literature many FEI limitations were revealed. Most studies addressing the front end activities mainly focus on 'idea generation and selection' (Alam 2006). For example, many studies deal with the sources of ideas and idea generation techniques (Sowrey 1990; Wagner and Hayashi 1994). More recent publications have focused on the management of idea generation and selection activities (Boeddrich 2004; Riel et al. 2013). As a result, little attention has been paid to the other activities at the FEI such as concept definition and evaluation (Alam 2006).

Concept definition and evaluation can be considered as decision making activities (Reid and De Brentani 2004; Gutierrez et al. 2008). Concept definition involves deciding on relevant information to include in a business case such as the specific concept characteristics, the customer needs, investment requirements, project risk, etc. Based on the defined case it is then determined whether to continue with the project, re-define the project or to reject the project (Yan and Ma 2014; Lin and Chen 2004; Gutiérrez et al. 2008). However, the ineffective running of these activities has led to difficulties (Hannola and Ovaska 2011). Research shows that it is difficult for managers to terminate projects once they have begun (Behrens and Ernst 2014; Balachandra 1984; Klingebiel and Rammer 2014; Cooper 2001). In many situations managers can become committed to failing projects. Consequently, they are less likely to terminate them after the 'go' decision has been made (Behrens and Ernst 2014; Schmidt and Calantone 1998).

Decisions are made on an ad hoc basis and ignore key information therefore inferior alternatives may be selected (Gregory et al. 2012; Hannola and Ovaska 2011). In addition, key information is often ignored if it is not exchanged effectively (Hannola and Ovaska 2011; Garvey 2014). However, effectively exchanging key information is difficult to achieve as information regarding service innovation is tacit, hardly formalised and barely supported by relevant tools (Bouwmann et al. 2008). This can impact on the decision makers understanding and their decisions in the innovation process (Hannola and Ovaska 2011). Ultimately,

decision making literatures suggest an appropriate set of methods or tools to facilitate decision making activities should lead to improved decision making (Gutiérrez et al. 2008; Archer and Ghasemzadeh 1999; Cooper et al. 2001). Despite this, little or no literature contributions that facilitate decision making at the front end of mobile service innovation exist (Bouwmann et al. (2008).

Another challenge recognised was that the NCD model (Koen et al. 2001) focuses on the creation of new products/services and not their 'adoption'. Furthermore, the majority of studies which focus on 'innovation creation' fail to consider the potential adoption or include 'adoption factors' (Koen et al. 2001; Bacon et al. 1994; Moenaert et al. 1995; Khurana and Rosenthal 1998; Langerak et al. 2004; Verworn et al. 2008; Verworn 2009; Poskela and Martinsuo 2009; Martinsuo and Poskela 2011). Yet facilitating adoption is vital for the success of innovations (Karhu 2007). As Michael Schrage of MIT suggests:

"Innovation is not innovators innovating, its customers adopting"

(Michael Schrage 2013)

The main decisions affecting adoption are made long before the actual product or service is launched (Karhu 2007; Rogers 1983). Therefore, when creating new products/services during the innovation process one should consider the factors that affect an innovation adoption and the consequences those factors may have on adoption. To date this also has been neglected.

3.2 Stage 1 Problem Identification: Expert Interviews

To understand the above mentioned challenges from an organisational perspective a series of interviews were held with industry experts following the approach outlined in chapter two, (section 2.3.1). The outcomes of these interviews are now summarised.

Firstly, the participants provided descriptions of their own innovation process which varies from organisation to organisation. Some participants suggested that they did not have an innovation process and they would begin in the design stage, while others indicated they had well-established innovation processes where they engaged in creative activities.

However, despite the various descriptions some common characteristics were found. This resulted in the research framework Figure 3.1. This is a conceptual model of the mobile service innovation process, including the front end activities. This is the first model to describe the activities at the front end of mobile service innovation. The model is shaped like a 'funnel' as the activities at the front end are categorised by low levels of formalisation and often remain unstructured and uncertain (Alam 2006). In contrast, the later design,

development and commercialisation activities are well defined (Koen et al. 2014; Koen et al. 2001; Alam 2006) and structured; hence the 'funnel' becoming narrower as you move from the front end into more organised activities. This research framework illustrates the research context. The first section highlighted represents the front end of mobile service innovation and the second highlighted section represents the specific activities in the research context - concept definition and evaluation. These are the activities this research focuses on and aims to improve.

The majority of participants described their front end activities as rather informal, and conducted in an ad-hoc fashion. Their descriptions of the front-end activities reflected the activities described in Koen et al.'s (2001) NCD model. The industry experts stated that their process began first by identifying opportunities or possible solutions to existing problems. One participant stated:

"A manager who is always on the go wastes a lot of time approving expenses as they can only access this from their desk … there is an opportunity here to create a way for the manager to approve expenses while they are on the go".

This provides an opportunity to look at possible solutions to the identified problem of "wasting the manager's time". This activity is akin to the opportunity identification activity described by Koen et al. (2001). Once they have determined that this is an important opportunity they wish to pursue, they then 'brainstorm' to create a list of new ideas to solve the problem. They stated:

"We could move the existing service into the mobile environment, allowing the manager to approve expenses via a mobile app… the service can be a simple approve/disapprove service or it can be more detailed allowing the manager to comment on particular expenses for review prior to approval".

They weigh up all their ideas and decide which the best to pursue is. These activities can also be likened to 'idea generation' and 'idea selection' activities described by Koen et al. (2001), Figure 3.1. They also stated that once they decided on an idea as the most appropriate, they then 'brainstorm' again to further develop the idea. They said:

"We then try and make the idea better, we will brainstorm again and try to vision how we would view the mobile expense approval service, what features, security issues and so on… at this stage we would need our vision of the mobile expense approval service to be strong enough to put forward for the business case".

This activity reflects the activity described by Koen et al. 2001 as 'concept development' as the selected idea is further developed into a concrete concept, ready to put forward for a business case. They indicated that during the analysis of the business case several factors are considered before the mobile service got the 'go-ahead'. This activity reflects the activity 'concept evaluation', Figure 3.1.

Figure 3.1 Framework of the Mobile Service Innovation Process
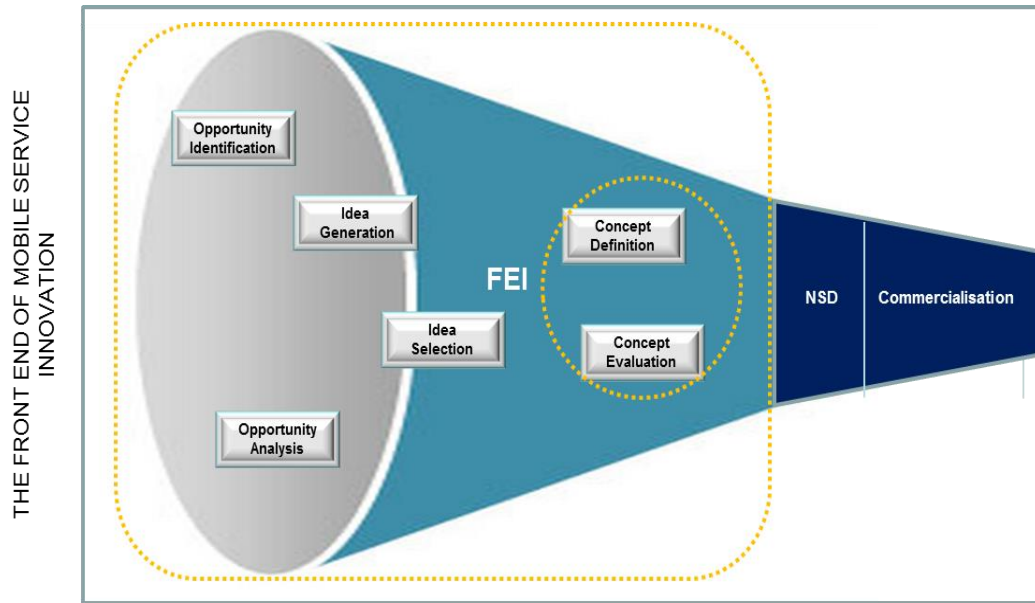
Adapted from Koen et al. 2001; 2014

3.2.1 Challenges at the Front End of Mobile Service Innovation recognised from an Organisational Perspective

The participants discussed challenges with the front end of their mobile service innovation process. Their submissions also reflected arguments found in the literature (Alam 2006). The experts also called for new approaches to assist the front end of mobile service innovation. More specifically, they suggested new approaches are badly needed to assist with defining and evaluating mobile concepts. They added that mobile service innovation is currently 'informal and unstructured' and common errors often occur. One common error is to reject a concept when it is potentially a possible success and another common error is to fail to reject a concept when it is a possible failure.

Most of the participants made references to these types of errors and therefore it can be inferred that that these are indeed common challenges at the FEI. These errors may result in managers failing to weed out the possibility of the mobile service failing or result in many worthwhile services being stopped, delayed or rejected. Participants agreed it was important to

have a strong concept definition and evaluation process at the front end, which can reduce the occurrence of these errors.

Nevertheless, it is clear-cut from both the literature examination and the industry expert interviews that concept definition and evaluation at the front end of mobile service are challenged. A solution to these challenges needs to be provided.

3.3 Stage 2 Identifying a Solution: Expert Interviews

This involved recognising the requirements to address the identified problems which formed two groups: 1) the requirements for the front end of the mobile service innovation that outline what is required to address the identified challenges at the front end and 2) the practical requirements so the research solution will be practical in its use. This was achieved by conducting additional interviews with the industry experts following the approach outlined in chapter two, (section 2.3.2). The outcomes of these interviews are now summarised.

3.3.1 Requirements for the Front End of Mobile Service Innovation

The requirements to address the challenges at the front end of mobile service from the participant's perspective are summarised in Table 3.1.

Process Structuring: To address the lack of structure in the innovation process and the ineffective running of the concept definition and evaluation activities, the experts proposed structuring these activities this is referred to as 'process structuring' (Table 3.1). To do this it is necessary to define and structure the key decision elements (adoption factors) needed to inform decision makers in the innovation process.

Effective Exchange of Information: To address the issue of ineffective exchange of key information, the experts recommended structuring the way information is exchanged at the front end this is referred to as 'effective exchange of information' (Table 3.1). The experts inferred that it was vital to ensure that the information exchanged is of good quality and fits its purpose. Therefore, the proposed solution needs to facilitate the exchange of good quality information when defining and evaluating mobile concepts.

Simplification of the Decision Situation: To improve understanding of key decision elements the participants indicated it was essential to streamline the concept definition and evaluation activities. This is referred to as 'simplification of the decision situation' (Table

3.1). As a result the research solution must simplify concept definition and evaluation activities to enable the decision makers to make more informed decisions.

Table 3.1 Front End of Mobile Service Innovation Requirements

Front End of Mobile Service Innovation Requirements		
Challenges	**Requirements**	**Requirement Description**
Lack of Structure and Transparency	Process Structuring	Define and structure activities. Define key information (e.g. decision elements/adoption information).Define roles.
Poor Communication	Effective Exchange of Information	Facilitate the effective exchange of good quality information when defining and evaluating mobile concepts.
Poor Understanding	Simplification of the Decision Situation	Simplify the concept definition and evaluation activities.

3.3.2 Practical Requirements

Table 3.2 summarises what is required for the research solution to be practical.

User Experience: The experts believed that in order for decision makers to understand the research solution it should be practical and provide a good user experience. Therefore the solution should require little effort for the decision makers to fulfil their task. They also requested for the solution to enhance their performance when defining and evaluating mobile concepts in order to be valuable.

Table 3.2 Practical Requirements

Practical Requirements	
Requirements	**Requirement Description**
Provide a good User Experience	Provide a valuable and useful experience.

3.4 Stage 2 Identifying a Solution: Literature Examination

This section summarises the literatures and core concepts which form the principles applied when creating the solution the aforementioned challenges. These principles are summarised in Table 3.3.

As both concept definition and evaluation are decision making activities, decision making literatures were reviewed. Weihrich and Koontz (1993) define decision making as 'the selection of a course of action among alternatives'. Over the years a number of decision aids have been developed to help decision makers. Fields such as decision analysis (Keeney 1982) and Model-based decision support systems, (DSS), (Turban et al. 2007; Niu et al. 2009) offer formal means for constructing decision models in which choice variables can be optimised (Ackoff 1979). While these are important contributions, limiting the view on confined optimisation runs the risk of disregarding contingencies of organisational reality (Ackoff 1979). More generally put, by Cabantous et al. (2010):

"Missing from [decision analysis] research is an analysis of sociotechnical conditions […] within organisational contexts".   Cabantous et al. (2010)

Cabantous et al. (2010) argue that overall support should look at rational decision making as a social practice in which rationality can be constructed. This is in contrast to previous studies who view rationality as something organisations may or may not have (Dean and Sharfman 1996; Brunsson 2007). From their perspective rationality becomes something that organisations can acquire if they wish and devote their efforts to it. Their perspective allows one to view the challenges at the front end such as lack of structure, poor communication and understanding as conditions which can be altered to facilitate rational decision making, as opposed to previous approaches which may ignore these factors and solely focus on 'optimising' choices (Keeney 1982; Turban et al. 2007; Niu et al. 2009). For this reason Cabantous et al.'s (2010) theory is considered relevant for this study to follow. Their theory compliments the prescriptive nature of this study and is suitable to ingrain in the design of a solution.

The prescriptive approach to decision making is concerned with how people ought to make decisions and aims to find tools, methodologies and/ or software, to help people make better decisions (Cabantous et al. 2010). Cabantous et al. (2010) suggest material artefacts embody a rational conception of decision making and hence can act as 'rationality carriers' which diffuse rationality through organisations. This implies that artefacts can be used ''in practice' as a vehicle towards making rational decisions. This was one of the main

inspirations for this research as an artefact can be created to improve decision making at the front end of innovation. Based on this concept, this research creates an interactive assessment instrument to assist concept definition and evaluation at the front end of mobile service innovation. Within this thesis this instrument is referred to as the Mobile Concept Assessment Instrument (M-CAI).

Cabantous et al. (2010) propose a three step process model to crafting rational decisions in practice. In particular their model consists of the core concepts 'Contextualisation', 'Quantification' and 'Calculation'. These core concepts can be ingrained in the design of the M-CAI (Table 3.3). These can facilitate the concept definition and evaluation activities and meet the necessary requirements of the innovation process.

Contextualisation is proposed to address the 'process structuring' requirement, Table 3.3. This involves specifying and structuring the key elements of the decision situation into a logical framework (Cabantous et al. 2010; Clemen and Reilly 2013). Gregory et al. (2012) suggest structuring decision making in a way that is transparent and rigorous by combining analytical methods drawn from the decision sciences with insights from cognitive psychology can inform decision makers and improve decision making. Therefore contextualising the decision situation will inform the team of key decision items when making concept definition and evaluation decisions.

To 'contextualise' the decision situation various models originating from different disciplines about factors that affect innovation adoption and usage are considered in a QCA. These models include the Technology Acceptance Model, (TAM) (Davis 1989; Davis et al. 1989), Theory of Planned Behaviour, (TPB) (Ajzen 1991), Innovation Diffusion Theory, (IDT) (Rogers 2003), the Unified Theory of Acceptance and Use of Technology, (UTAUT) (Venkatesh et al. 2003).

Stage two demonstrates the 'quantification' of the structured decision situation (Table 3.3). This consists mainly in turning decision parameters into numbers which can be modelled (Cabantous et al. 2010; Porter 1996). This can assist with addressing the second requirement (effective exchange of information). Cabantous et al. (2010) suggest equipping the decision situation with a 'calculative prostheses', which models the decision situation using a graphical form, will facilitate the collective discussion over the important parameters of the decision. This can enable the effective exchange of information amongst team members. Furthermore, Desanctis and Gallupe (1987) suggest supporting decision making involves changing in a positive direction the interpersonal exchange (the exchange of information among members) as the group progress through the decision making process. They suggest

changing 'the exchange' for example, by determining who speaks when, in what order about what will positively impact the decision making process (Desanctis and Gallupe 1987).

When altering the exchange of key information it is also vital to ensure the information being exchanged is fit for purpose (Lee et al. 2002) as poor quality information can lead to poor decisions (Ge and Helfert 2007; Ge 2009). Therefore, this is also considered when creating the research solution.

The final stage 'calculation' involves the effective mobilisation of entities previously quantified and the coordination of act-ants such as spreadsheets, computers and algorithms (MacKenzie 2006). This is as technology can be used to visualise the decision situation, for example through graphs and models. Modelling the decision situation enables decision makers to filter relevant dimensions, thereby simplifying the decision situation and improving their understanding of key decision elements (Marques, Gourc and Lauras 2011; Williams 1997).

Suitable literatures to support the practical requirements of providing a good 'user experience' were also examined. Shniderman and Plaisant's (2010), principles of design were deemed the most suitable to apply when creating the M-CAI as these are key to providing a good user performance (Table 3.3). As these principles emphases the importance of the user this research refers to them as the principles of 'designing with the user in mind'. Shneiderman and Plaisant (2010) suggest it is necessary to understand the user's skill level as no design would be ideal for all users. They also suggest it is important to identify and define the user's task as it is key in understanding the user's needs. Then an interaction style must be chosen to facilitate the users. In particular, by creating visual representations tasks can be greatly simplified as direct manipulation of familiar objects is possible. Finally, it is important to provide a consistent design. If the terminology is consistent, users will be able to easily learn and retain this information. This also includes the consistent use of colour, layout, icons, fonts, font sizes, etc. This is vital in giving users a clear understating of the design. These principles were applied throughout the design of the M-CAI.

In summary, these concepts are considered key when creating the M-CAI (Table 3.3).

Table 3.3 Principles

Requirements		Design Principles	Resources
Innovation Process	Process Structuring	'Contextualise' the decision situation. 'Quantify' the decision situation.	(Cabantous et.al 2010; Davis 1989; Venkatesh and Bala 2008; Schwenk 1984; McGilvray 2008; Lee et al. 2002).
	Effective Exchange of Information		
	Simplification of the Decision Situation	Facilitate the 'Calculation' of rational decisions.	
Assessment Instrument	Provide a good User Experience	Principles of design.	(Shneiderman & Plaisant 2010; Morville 2004)

3.5 Chapter Summary

This chapter presented the outcomes of the first two stages of the research process presented in chapter two. Both stages involved literature examinations and interviews with industry experts. Firstly, the examination of literatures on service innovation, the innovation process and the FEI revealed that most studies addressing the FEI focus on 'idea generation and selection' (Rochford 1991; Sowrey 1990; Wagner and Hayashi 1994; Boeddrich 2004; Riel et al. 2013). As a result, the succeeding activities are neglected (Alam 2006). In particular, it was found that there is a lack of research to support the 'concept definition and evaluation' activities. This lack of support and the ineffective running of these activities has led to difficulties such as managers becoming committed to failing projects (Behrens and Ernst 2014; Schmidt and Calantone 1998) as decision making activities are conducted in an ad hoc manner and ignore key information (Hannola and Ovaska 2011; Gregory et al. 2012). These challenges were reflected in the accounts provided by industry experts. This demonstrates how this problem exists not just in theory, but also in practice. To identify a solution to the recognised challenge, requirements were outlined based on additional interviews with the industry experts. In particular, they suggested that: process structuring, the effective exchange of information, simplification of the decision situation and a good user experience was needed. Finally, decision making literatures explored to help meet these requirements and inform a solution were presented along with the core concepts followed by this research. Based on these concepts this research creates an interactive assessment instrument to assist concept definition and evaluation at the front end of mobile service innovation, referred to as the Mobile Concept Assessment Instrument, (M-CAI).

Chapter 4: Design, Development and Refinement of the M-CAI

This chapter details the design and development of the M-CAI which is used as a vehicle towards improving the front end of mobile service innovation. The approach outlined in chapter two, (section 2.3.3), was followed. In addition, this chapter reports on the demonstration and refinement of the M-CAI and illustrates that this was an iterative process.

4.1 Identifying Factors for Inclusion in the M-CAI

A QCA was conducted to identify the key decision elements for mobile concept definition and evaluation. The approach to conducting this QCA has been outlined in chapter two, (section 2.3.3). The unit of analysis was selected based on the objectives in Table 4.1.

Table 4.1 QCA Objectives

	QCA Objectives
Objective 1	Synthesise the mobile service characteristics, which influence adoption of mobile services and construct a taxonomy of these factors.
Objective 2	Synthesise the context of use factors, which influence adoption of mobile services and construct a taxonomy of these factors.
Objective 3	From these taxonomies select factors to include in the M-CAI from a practitioner perspective.

The IS domain is relevant as there are a large number of studies here, which explain the influence of certain factors on the adoption and acceptance of mobile services. Although not directly related to user adoption or acceptance literatures the Human Computer Interaction (HCI) and Human Factors and Ergonomics (HFE) domains were considered as there are a number of studies here which document user's perceptions and experiences with mobile services. To avoid the omission of key considerations data sources were gathered from all three of these areas.

A key word search was completed using the following: 'user adoption' and 'user adoption of mobile services'. Although 'adoption' and 'acceptance' are different these terms are commonly used interchangeably in the literature, as a result the key word 'user acceptance' was also used to help find relevant articles (Holden and Karsh 2010). Moreover, only articles published from the year 2005 were considered (due to the novelty of mobile service innovations and the rapidly changing environment that would make an older article

obsolete). A practical screen (Okoli and Schabram 2010) was conducted to weed out articles based on the criteria outlined in Table 4.2 in order to restrict the total number of articles considered so that the review is practically manageable.

Table 4.2 Article Selection Criteria

	Selection Criteria
I.	Must capture impact of mobile services factors on user perceptions and adoption of mobile services.
II.	Must capture impact of context of use on user perceptions and adoption of mobile services.
III.	Must be published from 2005 onwards.

Following this a quality appraisal was conducted to score the quality of the articles included in the study. Using the three journal ranking charts mentioned in chapter two a total of 137 contributions were selected for inclusion (Appendix A). The citations provided in Appendix A were kept in a separate database to that of the research thesis. A numerical referencing index was used and is illustrated in Appendix B. In addition, 68 contributions were selected from online databases ACM Digital Library, ProQuest, EBSCO, Google Scholar (Appendix 4C). The corresponding citations for these sources are also recorded in Appendix B. Finally, computing surveys were also included in the QCA as they represent a summary of several previous results and therefore can be more influential than individual research papers. The corresponding citations for these sources are recorded in Appendix B. At the end of the screening process a total of 211 contributions, across three domains were selected for inclusion in the analysis. As outlined in chapter two, these contributions were then transported into NVio which is a qualitative data analysis software tool in order to conduct the analysis.

Once the relevant contributions were selected the data was organised through coding and categorisation. The coding process outlined in chapter two, (section 2.3.3), was followed. The outcome of this coding process was two initial taxonomies of factors which influence adoption (i.e. context of use taxonomy and mobile service taxonomy). As outlined in chapter two, the first focus group (Focus Group A) was then organised to refine the initial taxonomies.

Focus Group A: First a presentation was given to the participants and the objectives outlined. Following this the initial taxonomies of derived criteria from the open coding step were put onto yellow sticky notes and placed on the walls in a large room. The focus group objectives

were posted on orange paper and placed at the top of the wall to highlight the focus. Participants were told to read all the sticky notes on the wall. If at any time they felt that something should be added, renamed or be removed, they were asked to write it down on pink sticky notes and place them beside the factors they felt should be revised. The participants were not permitted to discuss their ideas at this stage. This prevented 'dominant characters' from influencing the results. Once all opinions and contributions had been posted participants were asked to group the criteria they felt belonged in the same category. The participants were then asked to read each group on the wall and consider its ranking. They now discussed their opinions with all views considered. A number of different opinions emerged from participants with different backgrounds. Discussions continued until there was a general consensus among the group. Final comments were made by the participants and the refined taxonomies emerged. The two refined taxonomies are illustrated in Appendix D and Appendix E.

4.2 Prioritising and Selecting Factors to Include in the M-CAI

As outlined in chapter two the second focus group was conducted (Focus Group B) to prioritise and select, (from the refined taxonomies), the 'top twenty' most relevant factors for inclusion in the M-CAI. These 'top twenty' factors were reduced further and the most important factors were selected by the broader community using an AHP technique (Saaty 1989).

Focus Group B: The focus group reviewed the taxonomies and prioritised the ten most relevant factors from each of the refined taxonomies. Ten from the mobile service taxonomy and ten from the context of use taxonomy. These prioritised factors are listed in Table 4.3.

Table 4.3 Top Twenty Most Relevant Factors

Practitioners Selection of Top Twenty Most Relevant Factors for Inclusion			
W/R	Context of Use Factors	W/R	Mobile Service Factors
1	Use Situation	1	Service Information Quality
2	Users Previous Experience	2	Trustworthiness
3	User Access Barriers	3	Convenience & Advantage of the Service
4	Awareness of the Service	4	Service Risk
5	Social Influence	5	Visual & Aesthetic Appeal
6	User Mobility	6	Service Cognitive Complexity
7	Relative Advantage	7	Service Output Quality
8	User IT Skill/Experience	8	Additional Support
9	User's Risk Aversion	9	Intuitiveness
10	Enjoyment	10	Novelty

AHP Technique: Using the AHP templates described in chapter two, (section 2.3.3), the participants compared and prioritised the adoption factors. This continued until all twenty participants had allocated a weight of importance to the mobile service and context of use factors. Once this was complete the factors with the highest weight of importance were calculated. The AHP analysis template calculates this automatically using the eigenvector principle. The results of this process are illustrated in Table 4.4 and Table 4.5.

Table 4.4 lists the prioritised mobile service factors. 'Service Information Quality' had the highest weight of importance by the participants (28.2%). This was followed by 'Service Complexity' (21.2%); 'Trustworthiness' (20.5%), 'Convenience and Advantage of the Service' (8.7%) and 'Intuitiveness' (8.2%). These mobile service factors are the top five mobile service factors deemed relevant by the participants. Any factors that received below 5% of importance were not included in the M-CAI (BPMSG 2012).

Table 4.4 Mobile Service Factors Weight of Importance Results

Criterion	Weights	Rk
Service Information Quality	28.2%	1
Trustworthiness	20.5%	3
Convenience & Advantage of the Service	8.7%	4
Service Risk	4.7%	6
Visual & Aesthetic Appeal	3.1%	7
Service Complexity	21.2%	2
Service Output Quality	2.7%	8
Additional Support	1.6%	9
Intuitiveness	8.2%	5
Novelty	1.1%	10

Table 4.5 lists the prioritised context of use factors. 'Use Situation' had the highest weight of importance by the participants (23.2%), followed by 'User Access Barriers' (18.3%), 'Awareness of the Service', (14.5%), 'Social Influence' (11.6%), 'Users Previous Experience' (11.1%), 'Relative Advantage' (7%), 'Task Urgency' (6.9%) and 'User's Risk Aversion' (5.7%). These context of use factors are the top eight factors considered relevant by the participants. Any factors that received below 5% of importance were not included in the M-CAI (BPMSG 2012).

Table 4.5 Context of Use Factors Weigh of Importance Results

Criterion	Weights	Rk
Use Situation	23.2%	1
Users Previous Experience	11.1%	5
User Access Barriers	18.3%	2
Awareness of the Service	14.5%	3
Social Influence	11.6%	4
User Mobility	0.8%	10
Relative Advantage	7.0%	6
Task Urgency	6.9%	7
User's Risk Aversion	5.7%	8
Enjoyment	1.0%	9

A summary of the selected factors for inclusion in the M-CAI are outlined in Table 4.6. This also includes definitions of each of the factors provided by the literatures included in the QCA, (Appendix B).

Table 4.6 Selected Factors for Inclusion in the M-CAI

Categories	Factors Selected		Definition
Mobile Service Factors	Trustworthiness		How free from risk the service will be. That it does not require or capture personal information, or if it does that the information is well protected and secure.
	Convenience & Advantage of the Service		The extent to which the service can be accessed by the user from any location at any point of the day.
	Service Complexity		This captures the complexity of the service in terms of: Mental Demands, Physical Demands, and Temporal Demands.
	Service Information Quality		This represents the quality of information content produced and offered through the service.
	Service Intuitiveness		The extent to which the service is natural or intuitive? This usually includes the simplicity and rationality of the service.
Mobile Service Context Factors	User Factors	User Access Barriers	This captures if the service caters for those who may be disadvantaged, to ensure that the service is accessible to as many people as possible.
		Users Previous Experience	This captures the user's previous usage experience, as a positive past experience can influence if a user will adopt the new service, (new version of the service).
		Users Risk Aversion	This refers to "the willingness to make oneself vulnerable to actions taken by the trusted party based on the feeling of confidence or assurance".
	Task Factors	Task Urgency	This represents if the service is supporting a time critical task.
	Technology Factors	Relative Advantage	The degree to which the new service is perceived as providing greater benefits than alternative or existing services.
	Environmental Factors	Use Situation	Conditions that users meet when they use mobile services in different places and times. The mediating use situation factors captured here include; Environmental factors, Attentional factors and Physical factors.
		Awareness of the Service	This refers to the degree to which users' are aware of the service.
		Social Influence	Social influence is the "degree to which an individual user perceives the importance that others believe he or she should use an innovation".

4.3. Creating Questionnaires and Scales

A mobile service will be characterised by various combinations of the selected factors (Table 4.6). In addition the potential adoption of these services will vary. For example, a transaction service will require a higher level of security than a learning service. As a result, it is necessary to create questionnaires and scales so the combinations of mobile service and context of use factors can be categorised. The approach outlined in chapter two, (section 2.3.3), was followed.

Mobile Service 'Type' Categorisation: Firstly the types of services were defined. There are many different types of mobile services (Nikou and Mezei 2013). Regarding this research, the types of services are based on select categories suggested by Nikou and Mezei (2013) and Nickerson et al. (2007). These include: communication, transaction, information, social media, learning and context sensitive services. Definitions and examples of these types of services are provided in Table 4.7.

Table 4.7 Mobile Service Type Categorisation

Mobile Service Types	Definition (Adapted from Nikou and Mezei 2013; Nickerson et al. 2007).	Example
Communication Service	Services which include content that can be both produced and consumed by users for communication purposes.	Instant Messaging (IM), Voice & Multimedia Communication, Mobile Email, etc.
Transaction Service	Services which involve conducting business, activities, to achieve a goal, such as scheduling or purchasing.	Reservation & Booking, Mobile Shopping, Mobile Banking, Ticketing and Mobile Stock Information etc.
Information Service	Services which allow users to consume, interact with, and produce information.	Weather/News Information, Live Information, Location & Map Information, Static-Recorded Information, Institutional Knowledge Services, Health Care records, Customer Information, etc.
Social Media Service	Services that integrate the social web within the concept of mobility, personal, localised, and always-on.	Social Networking Sites such as Facebook and Twitter that provide, collaboration or sharing of information between mobile service users.
Learning Service	Anywhere, any-time instruction delivered to learners. There are two primary models: synchronous (instructor-facilitated) and asynchronous (self-directed, self-paced).	Static Info, Video & Podcasts, Graphic Business Intelligence, Interactive Videos & Questionnaires, Classroom Experience.
Context Sensitive Service	Services that integrate a mobile device's location or position with other information so as to provide added value to a user.	Identity and Context Recognition Services, Advertising Services.

Categorising the services in terms of 'service type' allows adoption data (in the backend) to be filtered so that only adoption information relevant for the specific service is presented. These categories were structured in excel and form the first component of the M-CAI, Figure 4.1. The decision maker will select the particular type of mobile service they are creating from the dropdown list, (Figure 4.1).

Figure 4.1 Mobile Service Type Categorisation
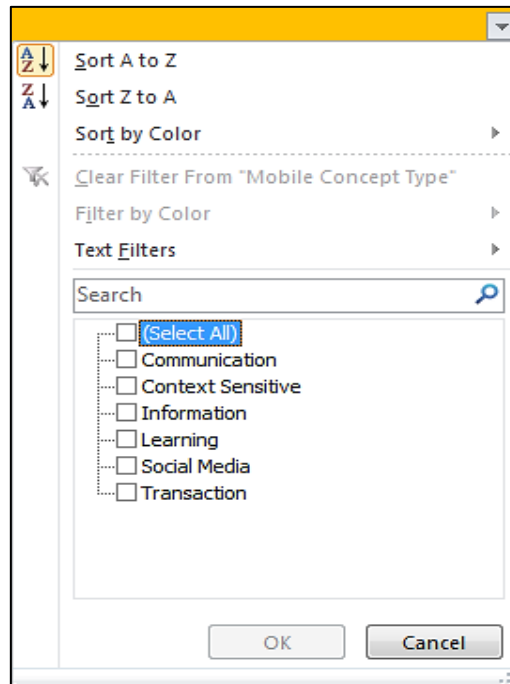
Mobile Service Questionnaire and Scale: To help define the particular mobile service characteristics (which the mobile concept is likely to comprise of) the selected mobile service factors Table 4.4 is used to create a mobile service questionnaire and scale. Questions which represent the selected factors are structured in excel (Figure 4.2). Possible answers to these questions, (categories), are created and structured on a scale next to the questions (Figure 4.2).

The decision maker will read each of the questions and allocate scores to the categories they feel best define their mobile concept (Figure 4.2). For example, the decision makers will consider the questions in relation to the service, trustworthiness, complexity, intuitiveness, etc. and allocate a score to the category (e.g. 0-100%).

Figure 4.2 Mobile Service Questionnaire and Scale

Influenceing Factor	Question	No.	*	0-20	21-40	41-60	61-80	81-100	Score	Total	Area(s) that need more focus
Mobile Service Factors Categorisation											
Trustworthiness	How would you score the concept in terms of trustworthiness?	1(a)	1						55		45
	How much control will the user have of their personal information? (e.g. will the service enable the user to determine when, and to what extent, information held about them is communicated to others?).	1 (b)	1						66	60.5	34
Service Complexity	How much mental activity (e.g. thinking, remembering, looking, searching etc.) will be required to use the service?	2 (a)	1						63		37
	How much physical activity (e.g. tapping, zooming, scrolling, data entry etc.) will be required to the service?	2 (b)	1						35		65
	How much time pressure will be put on the user due to the pace at which the service responds? (e.g. Ticketmaster, Ryanair -countdown/timeout).	2 (c)	0						0	49	100
Convenience & Availability of the Service	How easily available will the service be?	3	1						85	85	15
Service Information Quality	To what degree will the information offered by the service be relevant for the users task?	4 (a)	1						44		56
	To what degree will the information be produced or consumed in a timely manner?	4 (b)	0						0		100
	To what degree will the information produced or consumed be reliable?	4 (c)	1						59		41
	To what degree will the information required by the user to conduct their task be complete?	4 (d)	1						74	59	26
Service Intuitiveness	To what degree will the service be natural or intuitive?	5	1						53	53	47

54

Descriptions of each of the categories, (0-100%), will 'pop up' when the decision maker hovers over them with a mouse. An example of this is highlighted in Figure 4.3. These descriptions will help them when deciding which category best describes their mobile concept. The complete catalogue of these category descriptions is provided in Appendix H.

Figure 4.3 Category Descriptions Displayed to the Decision Maker

Context of Use Questionnaire and Scale: In a similar way, a context of use questionnaire and scale was created. Questions were created to represent the contexts of use factors and the possible answers were structured on scales to represent the possible categories to describe the context of use, Figure 4.4. Decision makers categorise their mobile concept in terms of its context of use, (use situation, user base, etc.), by allocating scores to the categories which best represent their mobile concept. Similar to the mobile service scale, descriptions of each of the categories, (0-100%), will 'pop up' when the decision maker hovers over them with a mouse. The complete catalogue of these category descriptions is provided in Appendix I.

Figure 4.4 Context of Use Questionnaire and Scale

Context of Use Categorisation											
Influenceing Factor		**Question**	**No.**	*****	**0-20**	**21-40**	**41-60**	**61-80**	**81-100**	**Score**	**Total**	**Area(s) that need more focus**
User Factors	**Users Previous Experience**	If the targeted user group have previously experienced a similar service (e.g. on desktop, or an existing service with the same goals) how would you score their previous experience?	6 (a)	1						47	47	53
	User Accessability and Access Barriers	How likely is the user to successfully accomplish the goals of the task? (e.g. this can be based on the users background such as: IT Experience, Physical Restrictions, Social Background ect.).	6 (b)	1						52		48
		How hard will the user have to work to acomplish the goals of the task?	6 (c)	1						52		48
		How anxious, discouraged or stressed may the user become? (e.g. this can be based on the users ability to deal with technostress).	6 (d)	1						48	50.6667	52
	Users Risk Aversion	How likely are potential users to share personal information? (e.g. entering personal information, creating a profile/account etc.).	6 (e)	0						0		100
Environment (Extenal) Factors	**Use Situation / Situational Impaiments**	How compatible will the service be with use situations, where environmental factors may impact use? (e.g. low light, glare, ambient conditions, noise, vibration tremor, extreme temperatures, rainwater, uneven terrain etc.).	7 (a)	1						53		47
		How compatible will the service be with use situations, where attentional factors may impact use? (e.g. physical obstacles, social interactions, divided attention, abrupt distraction etc.).	7 (b)	1						80		20
		How compatible will the service be with use situations, where physical factors may impact use? (e.g. impeding clothing, baggage, occupied hands, user or device movement, posture or grip, user fatigue etc.).	7 (c)	1						80	71	20
	Awareness of the Service	How aware of the service will potential users be? (e.g. if there is a strategy in place to create awareness about the service to ensure users will be familiar with the service).	7 (d)	1						9	9	91
	Social Influence	What degree of social pressure will the user feel? (e.g. pressure from colleges to join a group network; Facebook, WhatsApp, LinkedIn).	7 (e)	1						10	10	90
Technology	**Relative Advantage**	If a similar service exists, to what degree will using this service be more advantageous to the user than the currently existing service.	8	1						86	86	14
Task Factors	**Urgency of Task**	How urgent will the task that the mobile service is supporting be?	9	1						55	55	45

56

Mobile Adoption Questionnaire and Scale: The mobile service 'adoption' instrument proposed by Gao et al. (2011) was adapted and used to create a mobile adoption questionnaire and scale illustrated in Figure 4.5. This is a ratio scale ranging from 0-100%, where 0% represents little or low adoption and 100% represents high adoption. This scale is appropriate to quantify the adoption of mobile services and the range is (visually) compatible with the above scales. This instrument was structured in a separate spreadsheet in excel and used to aggregate and quantify the likely adoption of mobile services.

Figure 4.5 Mobile Adoption Questionnaire and Scale (adapted from Gao et al. 2011)

Measure of Adoption/Acceptance	Questions	0-20	20-40	40-60	60-80	80-100
Perceived Ease of Use (PEOU)	In this case, the users found the service easy to use.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	In this case, the users could easily achieve the goals of the service.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	In this case, the users found it easy to learn how to use the service.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Perceived Usefulness (PU)	In this case, the user found that using the service would enable them to achieve their goals efficiently.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	In this case, the user found that using the service would enable them to achieve their goals effectively	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	In this case, the users found the service to be useful.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Intention to Use (IU)	For this case, assuming they have access to the service the user intends to use it.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Given that they have access to the service the user feels that they will use it.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4.4 Creating Quantified Adoption Tables

Once the questionnaires and scales are created they are used to aggregate and quantify the adoption of existing mobile services. The approach outlined in chapter two, (section 2.3.3), is followed.

Aggregating Adoption Data: The studies included in the QCA were the main sources used. Scores to best categorise each specific study were subjectively allocated to the questionnaires and scales by the researcher. A separate excel sheet stored the data from each study under the following headings:

- Data source (author, title, etc.)
- Mobile service type (communication, transaction, information, etc.)

- Mobile service questions 1-11 scores
- Mobile service category average
- Context of use questions 1-12 scores
- Context of use category average
- Adoption questions 1-8 scores
- Average adoption

Quantified Adoption Tables: Next the aggregated data was clustered into groups in terms of 'service type' and the average adoption calculated for each group. For example, the adoption of all mobile services whose mobile service and context of use characteristics fitted into the category 0-20% was grouped together and averaged. This was completed for each category, (0-20%, 21-40%. 41-60%, 61-80% and 81-100%), representing each type of service (information, communication, transaction, etc.). This data was then structured into quantified data tables. An example of the quantified data table for information services is illustrated in Table 4.8. This summarises the possible adoption ranging from 0-100%, for each mobile service and context of use category. For example, a service consisting of mobile service characteristics that fit into the category 0-20% and whose context of use fits into the category 0-20% are expected to have a likely adoption score of 1.5%, Table 4.8.

Table 4.8 Quantified Adoption Data Table (e.g. Information Service)

Information			Adoption				
			0-20	21-40	41-60	61-80	81-100
	MS 80-100	100	45.80	64.90	77.30	85.00	90.00
	MS 60-80	80	11.40	42.60	63.44	76.31	84.40
Mobile Service	MS 40-60	60	1.50	6.20	39.20	60.60	74.50
	MS 20-40	40	1.50	0.00	0.60	35.60	58.30
	MS 0-20	20	1.50	1.50	1.50	1.50	31.80
			CT0-20	CT21-40	CT41-60	CT61-80	CT 81-100
			Context of Use				

Data tables were created for each of the six types of the services. These data tables are stored in the background of the M-CAI. These are used to link the adoption data to the mobile service and context of use questionnaires and scales.

4.5 Creating the 3-D Graph and Making the M-CAI Interactive

Next a 3D graph is created using the aggregated adoption data and the M-CAI is made interactive. The approach outlined in chapter two, (section 2.3.3), was followed. This involves:

- Illustrating the adoption data in a 3D graph.
- Linking the questionnaires and data tables to the 3D Graph.
- Filtering the data in terms of service type so only relevant information is illustrated.
- Specifying the adoption categories and colours.
- Presenting the relevant data depending on scores allocated to questionnaires.
- Presenting the relevant colours.

Firstly, a 3D graph was created using the data fields from the quantified adoption tables using excel. This is illustrated in Figure 4.6. This graph can assist decision makers to understand how the mobile service and context of use factors will positively or negatively affect adoption.

Figure 4.6 Potential Adoption Data 3D Graph
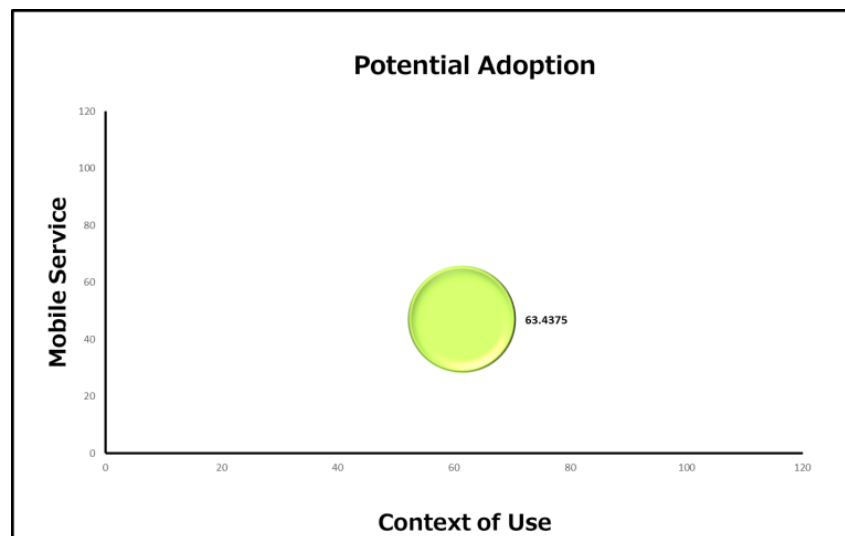
Following this a separate spreadsheet called '3D Graph Background' was created to link the questionnaire scores to the different data tables and the 3D graph. A table was created which included the following fields: X1 Mobile Service, X2 Context, Y Adoption, Visual and Colour. This is illustrated in Figure 4.7. The first field (X1) takes the average score allocated in the mobile service questionnaire. The second field (X2) takes the average score allocated in the context of use questionnaire. The third column (Y) takes the average adoption of that

group from the previously quantified data tables. The next two fields 'visual' and 'colour' are linked to the graph to ensure the graph presents the correct colour visualisation (bubble/circle). This separates the adoption data into categories. These categories are then colour-coded for a deeper visual effect. A traffic-light colouring system is used. Red indicates low adoption, dark green indicates moderate adoption and bright green indicates high adoption, Figure 4.7. Allocating the colours to categories enables more meaning to be provided to the graph. For example, in Figure 4.7 the mobile service received a potential adoption of 63.43%, which fits into the high adoption category (61-100%). Therefore, these fields ensure that the visualisation in the graph is 'bright green'.

Figure 4.7 Background of the 3D Graph
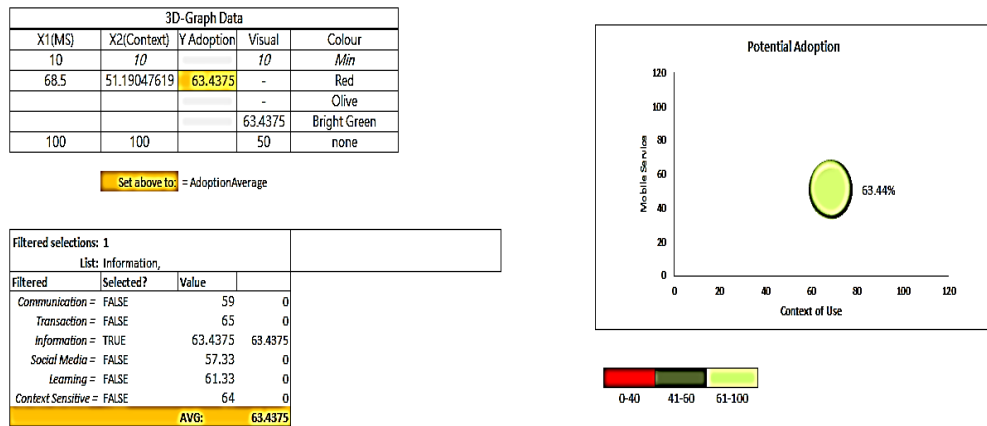
Figure 4.7 illustrates a second table on the bottom left-hand side. This table indexes the different data tables, (communication, transaction, information, social media, learning, context sensitive), and takes the single value from the relevant data tables based on the specific service type that was selected by the decision maker (Figure 4.1). Therefore, these tables link the questionnaires to the data tables and the 3D Graph while also ensuring that the data is taken from the relevant data tables.

Scroll bars were applied to the questionnaire in order to enable the users to directly manipulate the scores they allocate to the scales. Excel's 'Developer Tab' includes several controls which can be applied. In this case, the scroll bars were suitable as they allow the users to rapidly adjust the scores. Once the scroll bars were applied their properties were adjusted to link them to the correct data fields. This ensures the M-CAI meets the practical requirements. Finally, each element in the M-CAI was made consistent, for example, terminology, colour, layout, fonts, font sizes, scroll bars, etc. A screenshot of all four components of the M-CAI is illustrated in Figure 4.8.

Figure 4.8 The M-CAI

4.6 Demonstration and Refinement of the M-CAI

The M-CAI was refined over a period of six months based on expert feedback during group meetings. The approach outlined in chapter two, (section 2.3.4), was followed. As outlined, feedback was gathered from experts within a voluntary 'open-sourced' mobile service development organisation which consists of both experienced practitioners and scholars who create innovative and sustainable mobile solutions to solve real-world problems faced by communities across Ireland. The organisation holds regular meetings where the volunteers split into various teams and create new mobile service solutions.

During these group meetings the M-CAI was both demonstrated to and utilised by these volunteers. The voluntary meetings notably shaped the M-CAI. The experts reviewed the questions and categories and then made suggestions for refinement. This took place over a series of months until the experts suggested that the final version of the M-CAI was fitting. This approach was detailed in chapter two, (section 2.3.4). A summary of the participant comments and suggestions for refinement is outlined in Table 4.9.

Table 4.9 Participants Comments, Suggestions and Design Refinements

Participants Comments	Participant Suggestions	Design Refinements
The terminology needs to be more practice oriented as opposed to academic.	Providing definitions using industry standards with examples for each of the questions would prevent confusion.	Questions were re-worded to reflect industry standard definitions.
Categories need to be refined. It is unclear as of which categories the concept fit to.	To which category the concept should fit is confusing, clearly defining the scales and providing examples from a practical perspective would be useful.	Experts having good knowledge of mobile application innovation and development refined some of the categories to reflect conditions more relevant to practice.
A scale ranging from 0-100% provides more room to work with and it clearly emphasises the difference between categories.	A scale between 0% and 100% emphasises the difference between categories far more than a scale ranging from 1% to 5%.	A scale ranging from 0-100% was applied to all scales. This allows for the difference between the categories to be clearly distinguished.

The experts suggested that terminology needed to be refined. Consequently, it was necessary to adjust the terminology so it is suitable for practice. The questions were refined to reflect industry standard definitions. The experts also suggested some of the categories in the scales needed to be refined as some experts were unclear as of which category their concept would fit into. As a result the experts provided more realistic and 'practice oriented' categories for defining the mobile service factors. For example, in terms of 'convenience and advantage of the service' the practitioners suggested it would be more appropriate as 'availability or convenience'. They suggested, the possible platforms the service would be available on, (Android, iOS, Windows vs. PC, etc.), was a better way of categorising this. Finally, the experts suggested that the scale was appropriate as a range from 0-100% would allow the difference between categories to be clearly illustrated.

Overall, the refinement included several iterations over six months until the final version of the M-CAI was deemed suitable by both scholars and industry experts in the voluntary organisation.

4.7 Chapter Summary

This chapter has detailed the design and development of the M-CAI. A QCA was conducted to identify the key factors for inclusion in the M-CAI. This resulted in two taxonomies of factors, (Appendix D and Appendix E). These taxonomies were then refined during a focus group (A) with industry experts. To prioritise and select the factors most relevant for inclusion in the M-CAI a second focus group (B) was conducted. The twenty factors were selected and from these the most important were selected by the broader community using an AHP technique. Using these selected factors questionnaires and scales were created to categorise the mobile services and their context of use and to quantify their potential adoption. The aggregated and quantified adoption data (from the data tables) were used to create a 3D Graph and functions in the excel Developer tab were applied to make the M-CAI interactive. Finally, this chapter reported on the demonstration and refinement of the M-CAI based on feedback provided by experts within a voluntary open sourced organisation.

Chapter 5: Evaluation of the M-CAI

This chapter describes the evaluation of the M-CAI's impact on the front end of mobile service innovation. The evaluation propositions are specified and the participating case study organisations are profiled. Following this the three qualitative case studies are reported. Each individual case study provides an account of the organisation, its innovation activities, its participants and the mobile concept assessed by the M-CAI, together with the implementation of the M-CAI. Finally, the data collection, analysis and individual case findings are presented.

5.1 The Evaluation Propositions and Case Study Profiles

5.1.1 Evaluation Propositions

The evaluation propositions outlined in Table 5.1 were derived from the theory of crafting rational decisions ingrained in the design of the M-CAI (Cabantous et al. 2010) and from RQ 3 as described in chapter one, (section 1.4).

Evaluation proposition I, suggests that logically re-arranging the mobile service, context of use factors and potential adoption, (decision elements), into a 'new calculative space' to be quantified through the use of the M-CAI will add structure to the front end and make rationality more transparent in practice.

Evaluation proposition II, suggests that equipping the decision situation with a 'calculative prostheses' to model the decision situation using graphical forms, (M-CAI), will provide a visual aid for the organisational actors to filter the relevant mobile service and context of use characteristics and the potential adoption information. As a result, modelling the potential adoption will simplify the decision situation (Marques, Gourc and Lauras 2011) and consequently improve the decision makers understanding of the key decision elements.

Evaluation proposition III suggests equipping the decision situation with a 'calculative prostheses' to model the decision situation, (M-CAI), will enable collective discussions on factors and their potential impact on adoption. This in turn aids communication, (interpersonal exchange), among the organisational actors (Cabantous et al. 2010; Desanctis and Gallupe 1987).

Table 5.1 Evaluation Propositions (derived from Cabantous et al. 2010)

Evaluation Propositions and Rival Explanation	
Evaluation Proposition I	Re-specifying the current decision situation by separating key elements from the decision context and logically re-arrange them into a 'new calculative space' will add structure to the process thereby making activities and roles more transparent.
Evaluation Proposition II	Equipping the decision situation with a 'calculative prostheses' which models the decision situation using a graphical form, will enable decision makers to filter relevant dimensions, thereby improving their understanding of key decision elements, outcomes and decide if the decision situation is suitable.
Evaluation Proposition III	Equipping the decision situation with a 'calculative prostheses' which models the decision situation using a graphical form, will enable collective discussions over important parameters of the decision, thereby aiding effective communication between the organisational actors.
Rival Explanation IV	Transparency, communication and understanding at the front end of mobile service innovation are as a result of existing practices

In addition to the evaluation propositions, rival explanations are considered (Table 5.1). While it is impossible to examine every rival explanation, constraining the rival explanation to be investigated will frame the case study investigation (Yin 2013). The rival explanation implies the case study organisations existing practices are already effective and are not impacted by the M-CAI. Disproving this rival explanation can strengthen the study findings.

Finally, the case study data is examined for evidence of 'Rational Choice Theory, (RCT), performativity' (Cabantous et al. 2010; Callon 1998; MacKenzie and Millo 2005). RCT performativity refers to the influence of RCT theory (e.g. Cabantous et al. 2010) on the organisation's decision making practices (Cabantous et al. 2010; Cabantous et al. 2008; Callon 1998; MacKenzie and Millo 2005). If traced this would suggest the M-CAI has an impact on FEI decision making in practice.

5.1.2 Case Study Profiles

To 'replicate' the findings, multiple cases were selected. However, there is no set number of cases that must be included in a multiple case study design (Hesse-Biber and Leavy 2010; Patton 1990; Yin 2013). This evaluation was carried out using three case studies: two with similar characteristics with the objective of replicating the findings and one with different characteristics as a 'contrast case'. It is expected that there will be a variation in the case

study organisations characteristics due to the lack of standardised FEI procedures. As a result various criteria to profile the case studies were outlined, Table 5.2. These criteria are important for identifying the similarities and differences across cases (Patton 1990; Yin 2013).

Table 5.2 Criteria for Profiling Cases

Criteria	Variation	Description
Organisational Sector	Public Sector Organisation	Includes public bodies and any other organisation wholly or majority owned by a public body.
	Community and Voluntary Organisation	Organisations which meet the following criteria: - Non-profit making and non-profit distributing - Working exclusively in voluntary or community sectors - Run by unpaid volunteers
	Private Organisation	All for-profit businesses not owned or operated by the government.
Organisational Size	Small Organisation	An organisation that employs less than (<) 50 persons and has either an annual turnover not exceeding 10 million euro or an annual balance sheet total not exceeding 10 million euro.
	Medium Organisation	An organisation which employs less than (<) 250 persons and has either an annual turnover not exceeding 50 million euro or an annual balance sheet total not exceeding 43 million Euro.
	Large Organisation	An organisation which either employs greater than (>) 250 persons or which has either an annual turnover exceeding 50 million euro or an annual balance sheet total exceeding 43 million euro.
Establishment Date	Specific to each Organisation.	Date of establishment or date of founding of an organisation is the date on which that organisation chooses to claim as its starting point.
Actors Diversity	Specific to each Organisation.	This includes actors involved in decision-making, (practitioners) and may vary depending on the organisation. For example, some development teams may solely consist of developers while others may have project managers, designers, business analysts, marketing staff, etc.
Organisational Goals	Specific to each Organisation.	Organisational goals are strategic objectives that management establishes to outline expected outcomes and guide employee's efforts. These vary depending on the organisation. However a similar goal amongst all cases is to create and provide mobile service applications.
Innovation Process Activities	Specific to each Organisation.	These are the activities the organisation engages in during the innovation process, (concept definition and evaluation). This will vary depending on the organisation. For example, some enterprises suggest that they usually conduct informal, ad-hoc activities in the early stages, whereas others feel they have structured steps in practice.

Firstly, the cases are categorised in terms of organisation sector. This includes public, private or voluntary organisations Table 5.2. Secondly, the cases are profiled in terms of organisational size and the number of employees, according to definitions provided by the European Commission. These range from small organisations with less than 50 employees, to large organisations with over 250 employees Table 5.2. The cases are also categorised in terms of their establishment date.

In addition to these criteria Cabantous et al. (2010), Jarzabkowski et al. (2007) and Whittington (2007) suggests rational decision making involves the co-presence of three constitutive elements: 1) actors/decision makers, 2) activities, and 3) tools and models enabling their actions Table 5.2. The actors in all case studies are involved in decision making and experts/practitioners in the field of mobile service innovation and development. These include designers, developers, business analysts, project managers, IT and service support, and members of marketing. The activities refer to mobile concept definition and evaluation activities. These are determined by the organisational goals or objectives and vary across organisations. However, a similar objective amongst all cases is to create mobile service applications. The 'tool' enabling their actions within this study is the M-CAI.

The cases are profiled in Table 5.3 together with a summary of their mobile concepts for assessment. This involved two small private organisations with innovation processes described as 'semi-structured' and for contrast a large public organisation with an innovation process described as 'structured' was selected. Finding similarities or differences under varying conditions such as the above, (e.g. public vs private organisations, etc.), will lead to the conclusions and generalisations.

Table 5.3 Case Study Profiles

Case	Organisation Sector	Organisation Size	Estb.	Organisational Goals/Objectives	Innovation Process	Actors	Mobile Concept
1	Private	Small (<50 Employees)	1998	Private Mobile Application Development Organisation: They are one of the leading mobile application developers in Ireland. They provide cutting edge mobile services to both large and small scale clients and also develop in-house applications.	Semi-structured Formal but flexible innovation process	Project Manager, Design Engineer, Marketing, Software Engineer (2), Business Analyst.	Mobile Payment Transaction Service.
2	Private	Small (<50 Employees)	1999	Private Mobile Application Development Organisation: Their objective is to provide cutting edge web and mobile applications to large and small scale client as well as to create in-house applications.	Semi-structured Formal but flexible innovation process	Project Manager, Design Engineer (UX Speialist), Service Administration and Support.	Mobile Historic Information Service.
3	Public	Large (>50 Employees, e.g. 5700 employees)	1923	Public Organisation: Their objective is to provide services to the Irish people. Their mandate derives from obligations imposed by statute and by government as well as Ireland's membership of the EU. They provide a wide range of online and mobile services to the public and to businesses. Their objective is the adjustment and or creation of these public services.	Structured Formal innovation process	IT Project Manager, Live Sevices Manager.	Mobile Work and Payments Service.

5.2 Case Study One (CS1)

Case study one was conducted in a private mobile application development organisation based in Galway, Ireland. They are one of the leading mobile application development organisations in the country who provide cutting edge applications to both large and small scale clients. They develop in-house applications inspired by their creative team. The organisation is categorised as a small private organisation with less than fifty employees. Six members of their mobile application development team participated in the study, which included a project manager, a design engineer, a business analyst, two software engineers and a member from marketing.

5.2.1 CS1 Mobile Service Innovation Process

Their process for mobile service innovation was described as semi-structured. However, participants suggested that the level of structure depends on the individual mobile service. Mobile services created 'in-house' are prototyped almost immediately to grasp the 'look and feel' of the mobile application. For example, participant 3 suggested:

"If we came up with the concept internally within the team it would be fairly ad hoc, some of us come up with ideas and then share those ideas with the rest of the team to see what they have to add to it, usually over a conversation."

(Participant 3)

Alternatively, if the mobile concept comes from a 'client' the extent to which the innovation activities are structured depends on the client and their requirements. For example, some clients have a well-defined mobile concept that is usually ready for development, while others may only have a very vague concept that needs more innovating and planning. This indicates that their innovation processes are flexible and adjusts depending on their client's needs.

They also have formal client meetings where a 'statement of work' is drawn up. This gives their process an element of formality. This is the stage where the client decides based on costing whether or not to develop the application. If the 'price-point' is within their budget they are inclined to 'go-ahead'. For example, participant 1 suggested:

"The client usually if they get to that stage with us, are very much inclined to go ahead with it. It's a matter of getting a price-point, to find a way of doing it within their budget and with the level of detail that they want."

<div align="right">(Participant 1)</div>

All members indicated that they were open to adding structure and improving their existing process. For example, participant 5 stated:

"I think that we probably should change the way we make decisions in the early stages as it is important to have as much information as you can and we haven't been thinking about all the various aspects we could."

<div align="right">(Participant 5)</div>

To summarise, the innovation process of CS1 can be categorised as semi-structured having formal activities in practice that help create a price-point for the mobile concept, yet the process remains flexible as activities in the process adjust depending on clients' needs. However, there is no formal definition of the activities that take place within their innovation process.

5.2.2 CS1 Mobile Concept

A 'Mobile Payment Transaction Service' was proposed for this assessment. The aim of this service is to allow individuals to process small payment transactions in retail/mobile shops. For example, food at a grocery store or fruit and vegetables at a market stall on a smartphone anytime any-where. The idea was that the end users create an online profile and purchase tokens to use as credit for their products. The supplier approves payment of the products by selecting the 'approve' option when notified by the customer of the products they wish to purchase. The opportunity was recognised by the team when local petrol stations and nearby market stalls did not offer a credit card service or accept card payments for transactions under €10. The service will uses Bluetooth Low Energy (BLE) a wireless personal area network technology. Participating shops/stores will also have a BLE device such as a tablet positioned beside the till. When a user enters the shop they will be detected and they can use their device to process a transaction for products they wish to purchase. For example, if a user wants to purchase a newspaper at €2, they just sign into the service enter the item and the price and process the payment (their financial details have been pre-entered on installing the service). By the time they reach the cashier the item is already paid for and thus avoid checkout delays.

5.2.3 CS1 M-CAI Implementation and Data Collection

This section documents the implementation of the M-CAI in the innovation process in CS1 and its use by the participants to assess their mobile concept ('Mobile Payment Transaction Service'). The data collected from CS1 amounted to a total of 78 pages of qualitative data and was stored in the case study (NVivo) database for analysis. The implementation and use of the M-CAI is now reported.

Firstly, from the dropdown list the participants selected 'transaction service' as the category that best describes their mobile concept (mobile payment transaction service). Table 5.4 summarises the scores allocated to each question and their rationale.

M-CAI Question 1: Trustworthiness of the Mobile Service

The team agreed that their mobile service would be 'very trustworthy' and as a mobile payment transaction service, they suggested that security was the most important function for consideration. To use the service individuals must enter personal information such as their email address and bank account details in order to create a profile and purchase tokens. The use of 'Stripe' was suggested to assist this. They further suggested that marketing should create a strong brand to promote positive awareness of the security of the application and thereby ensure that potential users would perceive it as trustworthy. Furthermore, they strongly agreed that no personal information would be shared and that the user has control over their personal information such as private profiles with password protection.

M-CAI Question 2: Complexity of the Mobile Service

The team suggested that low mental activity is required to use the service. They agreed that it would involve some element of mental activity for the user to enter their username and remember their password in addition to selecting items for purchase. However, they felt this mental activity was extremely low. They also agreed that low physical activity is required to use the service. The design engineer guaranteed a minimum amount of steps to use the service by the user. Furthermore, they implied that low amount of time pressure was needed to use the service. They also suggested a time-out function to be included for security purposes. For example, the page will expire two minutes after inputting personal details. However, the user receives longer time intervals for buying credit tokens and for selecting items for purchase in shops.

Table 5.4 CS1 Defining the Mobile Service Characteristics

Factors	Q	Score	Description
Trustworthiness	1 (a)	97	Trustworthiness will be high as security is the most important function. Use of Stripe for processing transactions. A strong brand will be created and marketing promotes a positive attitude about security of the app.
	1 (b)	96	The user must submit personal information, but this information will not be shared.
Service Complexity	2 (a)	63	Standard - Remember passwords/username/ security questions.
	2 (b)	63	Input and interaction from the user is required – selection store, (when applicable), entering purchase items, entering card details, (if applicable).
	2 (c)	63	Needs to be very responsive and real time info update. Can introduce a time out function – page will expire after a certain length of time - mainly for security reasons.
Convince & Availability	3	95	Widely available across all platforms, e.g. – on the Play store – available for android devices, iOS, Windows, etc.
Service Information Quality	4 (a)	96	Very relevant – location will be pinpointed or if in an indoor shopping area there will be a selection of area in the vicinity to choose from.
	4 (b)	90	Updated in real time – information has to be instant.
	4 (c)	90	User details and location need to be accurate.
	4 (d)	81	The user will have to manually accept to pay for the items they wish to purchase. This interaction will only involve two presses on their device.
Service Intuitiveness	5	67	The process will be relatively intuitive and allow the user to process a payment with minimal interaction with the application.

M-CAI Question 3: Availability of the Mobile Service for Potential Users

The participants agreed to ensure that the service would be available across all platforms so that it could be accessed by potential users anywhere anytime.

M-CAI Question 4: Quality of Information Provided by the Mobile Service

The participants agreed that all information provided by the service will be aligned with the requirements of the user's task and will be relevant. For example, the service will provide a map with the user's location pinpointed and from here they can identify and select relevant stores. This lead to the following discussion – 'what if the user is in an indoor shopping area and there are multiple options?' They discussed this issue at length and concluded that if the user is in an indoor shopping area there will be a selection of shops in the vicinity to choose from. They agreed that they would not normally have thought of this until they had begun

designing the service. They also suggested that the information would be up-dated regularly or offer real-time-data to users. This sparked another discussion about how prices for items in a shop may change and how this information could be obtained. They also agreed they would include a feature where the user could enter the price of the item and the till operator approves the price change. In addition, they suggested that the information would be obtained from a known source, for example, the user will have to input their personal details to create a profile and purchase tokens. Finally, they implied that all information will be of sufficient depth and breadth for the user to complete their task. They also stated that all activities will be illustrated in a very straightforward way with the information necessary to understand these steps.

M-CAI Question 5: 'Intuitiveness' of the Mobile Service

The participants believed their mobile service concept fitted into the 'usable' category and suggested that the service would be sensible, learnable, guessable and trainable. However, the service could not be described as 'fully intuitive' as the user will need to experiment with the service when using it for the first time and it may take some trial and error before learning exactly how the service works. However, overall they described the service as predominantly intuitive, as it would allow the user to process a payment with minimal interaction with the application.

Next, the participants used the M-CAI to define the 'context of use' characteristics that best describe their concept. Table 5.5 summarises the scores the participants allocated to each question and their rationale.

M-CAI Questions 6: Potential Users of the Mobile Service

The participants suggested that the targeted users have a negative experience with existing services when making small payments in local shops with their debit/credit cards as most retailers will not accept card payments unless they are above a minimum spend. They suggested using their novel service the user is likely to have a good performance. They implied that they will ensure that the service caters for users from all backgrounds. For example, people with minimal experience will be able to successfully purchase or approve items in a shop. The user will not have to work too hard to accomplish the goals of the task and it is likely that the user will not become anxious or stressed when using the service. The group spent a large period of time discussing their target users. Finally, they suggested that the target users would be willing to share information, (creating a profile), as they may already be familiar with purchasing items online, or using online banking and so forth.

M-CAI Question 7: Environmental Factors that impact Use of the Mobile Service

The participants suggested that the service will be compatible with use situations where environmental factors can impact the use. They proposed that signal disruption and lighting conditions would be considered. One member recommended using iOS basics to ensure appropriate colours are selected for varying light situations. They also mentioned that the service would be compatible with use situations where attention factors may impact use. In particular, they suggested the application will be designed so that distractions or social situations would not impact use. For example, the interface will ensure minimal input and hence not interrupt the natural flow of the shopping process. They also implied that the service will be compatible with use situations where physical factors may impact use and discussed many scenarios where physical restrictions such as baggage and disabilities may cause some difficulty when selecting items for purchase. User awareness was considered extremely important to ensure that the service would become a widely accepted payment method. They realised that marketing would have a much larger role in the project than previously anticipated. Finally, they proposed some social components to be added to the service such as links to Facebook and Twitter, etc. However, this aspect would be limited as its primary function is transaction/payments.

M-CAI Question 8: Advantage of New Service over Currently Exiting Services

The participants suggested that it would be more advantageous to use this new service as it will allow a user to complete a payment transaction before reaching the cashier therefore saving time for the user.

M-CAI Question 9: Urgency of the task

The participants felt that this question was not applicable for this service and consequently it was marked, (N/A).

Table 5.5 CS1 Defining the Context of Use

Factors		Q	Score	Description
User Factors	**Users Previous Experience**	6 (a)	40	Users previously have a negative experience when making small payments with their debit/credit cards as most retailers do not accept payments under 10 euros.
	User Accessibility and Access Barriers	6 (b)	93	Very likely – the app must cater for users of all backgrounds, (people with minimal experience in using mobile devices, disabilities, etc.), – it will be intuitive and easy to use for all users.
		6 (c)	93	Must be as intuitive and as easy to use with as little steps involved as possible
		6 (d)	67	The service will be used in a public area which may include queues of people. The service must perform at a fast pace and be responsive in this environment to avoid the risk of the user becoming anxious/stressed.
	Users Risk Aversion	6 (e)	95	As it is a transaction service – need to register personal details name, address, and bank details, (once off submission of data). The users will be made aware of this before the app is downloaded.
External Environment Factors	**User Situation**	7 (a)	93	Signal disruption or lighting could be a factor, cross body interference– appropriate colours used / set brightness of the screen on the app.
		7 (b)	92	The application will be designed to cater for physical and social situations that the user encounters. The interface will allow the user to use the application with the minimal input, therefore not interrupting the natural flow of the shopping process.
		7 (c)	69	Method of payment and use of the application will allow a user to easily pay for items without disruption to their normal shopping process.
	Awareness of the Service	7 (d)	90	Very aware – the service must be widely advertised and promoted to reach potential users to be a widely accepted method of payment.
	Social Influence	7 (e)	88	Functions will be included to increase social awareness/pressure - But this aspect will be limited as its primary function is transaction/payments.
Technology Factors	**Relative Advantage**	8	90	The service will allow a user to complete a payment transaction at a faster pace and before reaching the cashier therefore saving time for the user.
Task Factors	**Urgency of the Task**	9	N/A	Non Applicable.

Based on the scores allocated to each question the M-CAI calculated the 'potential user adoption' and illustrated it in the 3D graph Figure 5.1. The potential adoption score was 90% that indicates that the mobile service concept fitted into the category 'high intention to adopt'. A high adoption score indicates that potential users are likely to have high intention to use the mobile service.

Figure 5.1 CS1 Potential Adoption
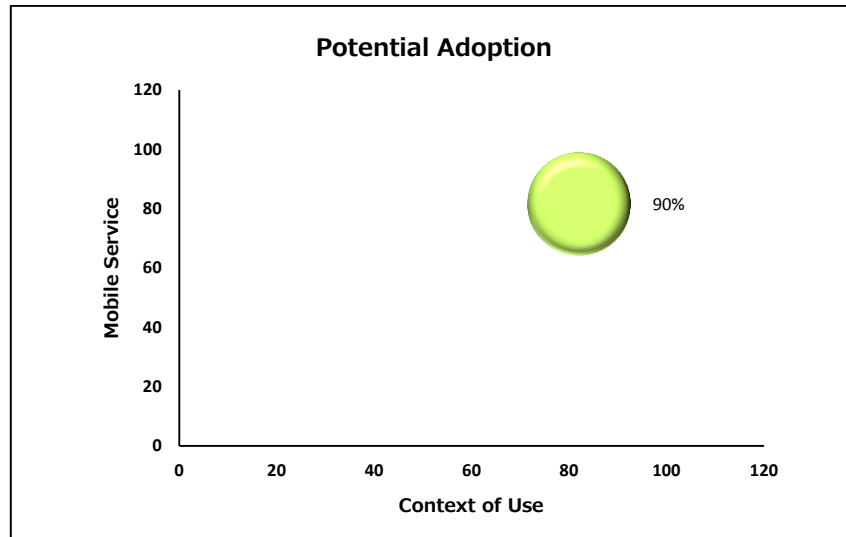
5.2.4 Data Analysis and Findings

The approach to analysing the data outlined in chapter two, (section 2.3.5), was followed. The corroborated themes are summarised in Table 5.6. This table includes each of the themes present in the data, (including subordinate themes) and the number of references each theme received from the various data sources in CS1.

Table 5.6 CS1: Corroborated Themes

THEMES	D	FN	T	P1	P2	P3	P4	P5	P6	Total
COMMUNICATION	1	4	0	3	2	3	3	3	3	22
Information Exchange	1	3	0	4	1	1	2	2	3	17
Engaged Exchange	1	4	0	2	1	1	1	2	2	14
Integrated Exchange	0	3	0	3	1	1	2	2	2	14
Quality of Information Exchanged	0	1	0	1	0	2	1	0	1	6
Complete Information	0	1	1	1	0	0	1	0	1	5
Relevant Information	0	1	1	0	0	2	2	1	0	7
										85
TRANSPARENCY	0	1	1	2	0	1	1	1	2	9
Control	0	1	0	0	0	1	0	1	0	3
Structure	3	1	1	4	3	1	2	4	1	20
Structure of Activities	3	1	1	2	4	2	1	2	1	17
Structure of the M-CAI	0	1	1	2	1	1	2	1	1	10
Thoroughness	2	2	1	3	2	0	4	2	0	16
										75
UNDERSTANDING	1	3	1	1	2	2	3	2	1	16
Guidance	0	3	1	1	0	0	1	2	1	9
Simplification	0	1	1	5	2	0	1	1	4	15
Understanding of Roles	2	1	1	1	3	1	1	3	1	14
Understanding of the Mobile Concept	1	2	1	5	2	2	4	2	4	23
Consistency	0	2	1	0	0	1	0	0	2	6
										83
RATIONAL CHOICE THEORY PERFORMATIVITY	1	5	1	0	0	0	3	0	1	11
Barnesian Performativity	1	1	0	1	0	0	1	0	0	4
Effective Performativity	0	3	0	4	0	1	3	1	2	14
Generic Performativity	0	7	1	0	1	0	3	0	1	13
Subjective Probability	0	6	1	0	0	0	2	0	0	9
										51
USERS EXPERIENCE	0	1	0	2	1	0	2	1	1	8
Ease of Use	0	1	0	3	1	2	1	0	2	10
Value	0	1	0	2	3	0	4	1	1	12
Efficiency	0	1	0	2	1	0	1	1	1	7
Usefulness	0	1	0	1	0	1	1	1	1	6
Appropriateness	0	1	0	2	2	0	1	1	1	8
										51

I.   Communication:

Communication and its subordinate themes were referenced 85 times as summarised in Table 5.6. There are two second order themes defined under communication: 'information exchange' and the 'quality of the information exchanged'.

Information Exchange: the data describe the participants as 'engaged' while exchanging information during the innovation process. For example, the project manager when referring the M-CAI suggested that the team were more engaged with each other when defining and

evaluating the mobile concept Appendix J (P1, L23). Further data suggest the diverse participants were involved in defining the mobile concept and therefore were well engaged Appendix J (P3, L24). Additionally, the data highlights that exchange of information among participants in the innovation process is more integrated Appendix J (P5, L25). This was also inferred by the project manager who felt that the M-CAI encourages a deeper discussion about the concept, particularly with those outside their area of expertise Appendix J (P1, L26). Based on this it can be argued that the exchange of information in the innovation process was inclusive as all members took part in the discussions to define the mobile concept. This is backed up with further evidence when the business analyst claimed that the M-CAI led to more integrated discussions. She implied that some members have suggestions or ideas that would not normally be considered until much later in the process. Using the M-CAI helped to be more open in the early stages Appendix J (P4, L27).

Quality of the Information Exchanged: the data described the information exchanged during the innovation process as relevant and complete. Evidence suggests that the M-CAI has affected completeness of information exchanged Appendix J (P3, L28; P1, 29). This was suggested by the business analyst who implied that a more complete discussion was undertaken Appendix J (P4, L30). Evidently, using the M-CAI in the innovation process involves more than an informal discussion and consequently, the information exchanged is more complete. The information exchanged was also described as 'relevant', as the relevant information necessary to define the mobile concept was provided in a more structured way Appendix J (P3, L31). Further data suggest that having used the M-CAI the participants believed the mobile service was more deeply defined Appendix J (FN, L32). They agreed that the information generated was useful when considering factors such as budget and resources. They realised marketing would have a bigger role in the project than previously anticipated. This in turn impacts the cost and human resources. Therefore, this shows that the M-CAI provides relevant information for the innovation process.

II. Transparency

Transparency and its subordinate themes were referenced 75 times as summarised in Table 5.6. There are three second order themes captured under transparency: 'control', 'structure' and 'thoroughness'.

Control: refers to the participants' management of the activities in the innovation process. For example, the marketing participant suggested that the M-CAI adds an element of control to the process by allowing identification of where errors may occur and whether or not the right choices are being made Appendix J (P3, L33). This suggests that the M-CAI helps the

management of activities as it indicates whether a particular element of the mobile concept needs to be re-considered before moving forward with the project. Furthermore, the business analyst implied that the activities were more transparent and as a result easier to control Appendix J (P4, L34).

Structure: was broken down into structure of activities and structure of the M-CAI. When referring to the activities in the innovation process, the structured questions included in the M-CAI ensured that the participants stayed focused on a specific list of items and consequently the mobile concept was defined Appendix J (P2, L35, P6, L36). Evidence for this was found when the design engineer suggested that the M-CAI creates a structured environment where the team have a 'dedicated time and space' to define to concept Appendix J (P2, L37). The project manager implied that the M-CAI added an element of formality to the process as it involves defining and evaluating mobile concepts in a more organised manner Appendix J (P1, L38). With reference to the M-CAI the project manager liked the way the questions were assembled with the adoption graph and stated it was 'well structured'. This opinion was also shared by one of the software engineers Appendix J (P6, L39). Therefore the steps involved in the M-CAI are arguably more structured than current informal discussions.

Thoroughness: The project manager suggested that the act of defining the mobile concept is more thorough as there is a more comprehensive list of items to be specified Appendix J (P1, L40). Furthermore, both the design engineer and the business analyst stated that their usual process was not thorough enough Appendix J (P2, L41, P4, L42). The design engineer advised that they didn't get enough time to discuss the user requirements. The business analyst indicated that they do not normally cover all of the items included in the M-CAI. Subsequently, when using the M-CAI defining and evaluating the mobile concept is more rigorous. This is backed up by references from one of the software engineers who suggested they were now discussing more parameters of the mobile concept than they usually would Appendix J (P5, L43). This further indicates more thoroughness in defining and evaluating mobile concepts once the M-CAI is applied.

III.   Understanding

Understanding and its subordinate themes were referenced 83 times as summarised in Table 5.6. There are two second order themes captured under understanding: 'simplification' and 'guidance'.

Simplification: was broken down into understanding of the mobile concept and understanding roles. In terms of 'understanding roles' the M-CAI makes the process of comparing alternatives and their consequences easier for decision makers Appendix J (P1, L44). For example, the M-CAI helps to shed light on the decision maker roles and responsibilities in the innovation process Appendix J (P2, L45). Field notes indicate that the participants became more aware that marketing had a much larger role to play in the project. The design engineer advised that this would not have become evident until much later in the project if they had not used the M-CAI Appendix J (P2, L46). Consequently, at the end of the session they recognised that they would need to allocate more of the project resources to marketing.

The M-CAI also helps to shed light on the participants' understanding of the mobile concept, as each member had some input into the task and therefore a good understanding of the concept Appendix J (P2, L47). The project manager stated that the M-CAI made it easier to understand the overall aim of the mobile concept Appendix J (P1, L48). To cement this point a member from marketing argued that all members understood the concept better Appendix J (P3, L49). This theme was broken down into to a fourth order theme, namely 'Consistency' as the data implied that the participants had a consistent understanding of the mobile concept Appendix J (P6, L50).

Guidance: the data suggest that the M-CAI guides the innovation activities Appendix J (P5, L51). This illustrates that the M-CAI guides the definition and evaluation of the mobile concept. Additionally, another software engineer suggested that the 3D Graph with the adoption information was very useful for it guided them in making better choices Appendix J (P6, L52).

Rational Choice Theory, (RCT), Performativity

RCT performativity and its subordinate themes were referenced 51 times as summarised in Table 5.6. There are two second order themes captured under RCT performativity: 'Generic Performativity' and 'Effective Performativity'.

Generic Performativity: refers to the mobilisation of the core concepts of Cabantous et al.'s (2010) theory in practice, (the innovation process). Field note data captured the participants calculating a potential adoption score based on the scores allocated to the M-CAI Appendix J (FN, L 53). Consequently, the concepts 'contextualisation, quantification and calculation' have been enacted in practice through the use of the M-CAI. This was broken down into a third order theme: 'Subjective Probability'. This has been traced as the field-notes imply that

the participants were likely to go ahead with the concept based on the outcomes of the process Appendix J (FN, L 54).

Effective Performativity: was traced in the data. From the 3D graph in the M-CAI the participants got an indication that they were making the right choices. As a result the project manager suggested that this would make the remaining of their activities easier Appendix J (P1, L 55). This implies that the M-CAI has made a difference to the innovation process. Barnesian Performativity was not traced in the data nevertheless references to this have been made as it may be possible for this to be traced in future investigations. For example, the manager believes the M-CAI has added to their process and imagines it would fit well with their current activities Appendix J (P1, L 55).

User Experience

UX and its subordinate themes were referenced 51 times as summarised in Table 5.6. There are two second order themes captured under UX namely, 'ease of use' and 'value'.

Ease of use: The project manager implied that the M-CAI was easy to use. For example, he suggested the questions and scales were presented in a very 'straightforward' way which made using it quite easy Appendix J (P1, L 56). The business analyst also shared this opinion Appendix J (P4, L 57). Arguably, little effort was required to use the M-CAI.

Value: is broken down into two third order themes - 'usefulness' and 'efficiency'. Many references to usefulness were made Appendix J (P4, L58-59; P1, L60). The theme 'usefulness' was broken down into a 4th order theme 'Appropriateness' as one of the software engineers felt the M-CAI would fit in well when documenting the statement of work Appendix J (P6, L 61). Evidently, the M-CAI is appropriate for CS1s innovation activities. References to 'efficiency' were also made Appendix J (P1, L 62). Notably, the M-CAI impacts on the time spent by the participants to achieve their goals, (e.g. concept definition), Appendix J (P2, L 63).

5.3 Case Study Two (CS2)

This study was conducted in a private web and mobile application development organisation, based in Dublin, Ireland. The organisation creates mobile services for both large and small scale clients in addition to creating their own 'in-house' applications. The organisation is categorised as a small private organisation with less than fifty employees. Three members of their mobile application development team participated in the study. These participants included a project manager, (also a senior software engineer), a designer, (specialising in UX design) and a member from service administration and support.

5.3.1 CS2 Mobile Service Innovation Process

Their process for mobile service innovation was described as semi-structured. The participants stated that the mobile applications they create usually stem from opportunities recognised by clients and that the services they create are usually generated by their client's needs. However, if they recognise an opportunity for a mobile service which could potentially have a strong user base they would create it. For example, participant 9 suggested:

"Mainly our 'innovation' is generated by business or our client needs… they may have a concept with specific functionality or features that they are looking for and we would see how feasible it would be for us to implement it… however, we would also go ahead and develop our own mobile apps if we thought there would be a user base for them."

(Participant 9)

They stated that once the opportunity for the mobile service was recognised they would generate some initial ideas with the client if they had not already done so. They advised that the mobile concept may target the needs of the client's workforce or a consumer base. To do this they would brainstorm and create personas and use scenarios. For example, participant 9 stated:

"We would then brainstorm some initial ideas with the client if required, and create provisional personas and scenarios in terms of the users. This would be based our experience with services we have created previously".

(Participant 9)

At this stage they would sit down together to further discuss the concept and draw-up a prototype. They would then have special interest group, (SIG), meetings which are formal meetings with the client where they create a document going forward that states the service

requirements and the time-frame for completion of the mobile service. The SIG meetings review the concept feasibility and based on this, accept or reject the project. For example, participant 9 suggested:

"After the SIG meetings we would create a proposal which will go to the project managers who then speak to the developers and get a timeline as of how long it would take for them to complete the project or how complex it would be to implement. Depending on the feasibility, these proposals are either rejected or accepted by both the management and the development sides input. If the idea is something simple we will implement it, however, if it is impossible… which sometimes what they ask for is, we would state what can and cannot be done, or it would just be rejected."

<div align="right">(Participant 9)</div>

Overall, CS2's innovation process is categorised as semi-structured. They have formal activities in practice such as SIG meetings yet the process still remains flexible. The activities in the process adjust depending on their clients' needs.

5.3.2 CS2 Mobile Concept

A 'Historic-Information Mobile Service' was proposed for the assessment. The aim of the service is to make historical information more accessible to the average person. The service will include a map with 'time capsules' throughout various locations. These time capsules will include stories of events which took place at these locations. There will also be a 'news-feed' where different stories that have been shared can be read. There will be a GPS prompt, which will send a notification when passing an area on the map which has been allocated a time capsule.

5.3.3 CS2 M-CAI Implementation and Data Collection

This section documents the implementation of the M-CAI in the innovation process in CS2 and its use by the participants to assess their mobile concept, ('Historic-Information Mobile Service''). The data collected from CS2 amounted to a total of 60 pages of qualitative data and was stored in the case study, (NVivo), database for analysis. The implementation and use of the M-CAI is now reported.

Firstly, from the dropdown list the participants selected 'information service' as the category that best describes their mobile concept, (mobile historic information service). Table 5.7

summarises the scores the participants allocated to each question relating to mobile service characteristics and the rationale behind it.

M-CAI Question 1: Trustworthiness of the Mobile Concept

The participants stated that their mobile concept would be 'trustworthy'. They suggested that the information consumed and produced by the service is not sensitive, therefore little measures will be needed to protect the information. The user shares a historic story and no personal information is required. Furthermore, the user will have full control over information published in the service. For example, the user will have the options to edit or delete information they share and also have the option of a 'private map' where the stories they upload can only be viewed by those within their network, (private or public map option).

M-CAI Question 2: Complexity of the Mobile Service

This involved much debate as one participant suggested that there would be very little mental activity required to use the service being a leisure service, (e.g. reading stories). However, another member advocated that there would be a moderate amount of mental activity required to use the service. They suggested building a 'scanning option' which enables the user to scan 'hard to read' documents or pictures into the service. The scanning function locks the camera onto the documents being uploaded and provides precision of documents compared to a simple camera upload. After much debate they concluded that the scanning option may cause the service to be overly complex and decided to leave this function out. In general, they felt that the mental activity would be low as long as the features were kept simple. In terms of physical activity, (interaction), the participants suggested that a significant amount of interaction is required to use the service as they need to upload information such as documents, pictures, or stories, which involves a significant amount of direct manipulation - zooming and scrolling. They also stated that there would be no time pressure on the user. As a result, they felt question 2 (c) was not applicable to them and marked this as non-applicable, (N/A).

M-CAI Question 3: Availability of the Service for Potential Users

The participants said that they would ensure the service is available across all platforms and can be accessed anywhere anytime.

Table 5.7 Defining the Mobile Service Factors

Factors	Q	Score	Description
Trustworthiness	1 (a)	55	The user will have to create a profile with a user-name and password other than that no other personal information is stored. Therefore the security element required is not high, as the information contained in the service is not sensitive.
	1 (b)	85	The user has control over information in the service to delete/ edit information and have the option of having a private map or public app. There are restrictions on who views the data, (those who you are connected with in your private map). The information is in the public domain, but the user can remove it and change the sharing and privacy options.
Service Complexity	2 (a)	85	There may be a scanner option – possibly/possibly not suitable on the mobile. This functionality – scanning option may cause the app to be overly complex. Scanning functions – locks on to your document. E.g. certificates. Take a picture – army records may be difficult to read. Content menu different ways to upload your content, (Picture, information post, web-page, etc.) Functions will require very little mental activity. When consuming information there is very little mental activity required - the information is prompted the user just reads it.
	2 (b)	40	A significant amount of interaction is required to upload information, taking pictures, scrolling, zooming, etc.
	2 (c)	N/A	There is no time element present
Convince & Availability	3 (a)	80	The service will be available on Android and iOS, (HTML5 App e.g. with web-wrapper for iOS). Mobile only strategy.
Service Information Quality	4 (a)	50	The information content in the app is crowdsourced, but will be moderated by administrators similar to wikis and boards.ie to ensure that information will be relevant and to ensure information is monitored. Possibly have a rating process, e.g. a moderator to access the stories so that people don't upload irrelevant information. The administrator / moderator can monitor and remove information that is not relevant.
	4 (b)	N/A	This is not applicable as all content is historical data and even if data is no longer available the content will be stored in a database – e.g. picture.
	4 (c)	45	Some stories will require evidence, (pictures, etc.) Maybe create a profile for the end-user to provide some background on the source of the upload information. Information may be rated – some stories will be verified and others may not, but they are open to the public for interpretation.
	4 (d)	85	The service will include full information for the user to accomplish their task. Methods of uploading info may be limited. Service will be very user friendly and explained.
Service Intuitiveness	5	70	The service is classified as usable. Will take some initial trial and error, but overall will be intuitive.

M-CAI Question 4: Quality of Information Provided by the Service

This question sparked much discussion amongst the participants. One participant asked: "What if the information uploaded was not relevant?" To ensure that the information included in the service was relevant the participants agreed it should be moderated by administrators.

They discussed whether they should include verified, non-verified stories or both and the possibility of having a rating process where a moderator could monitor and remove information that was not relevant. They suggested that information could be uploaded from a known or unknown source. They agreed that while some of the stories may not be verified, it would be up to the individual to interpret them. Finally, they implied that all information would be of sufficient depth and breadth for the user to complete their task.

M-CAI Question 5: Intuitiveness of the Service

They described the service as 'usable'. The service could not be described as 'fully intuitive' as the user would need to experiment with the service if using for the first time, (trial and error). Despite this they believed the service will require little effort and overall would be intuitive.

Next, the participants used the M-CAI to define the 'context of use' characteristics that best described their concept. Table 5.8 summarises the scores the participants allocated to each question and their rationale.

M-CAI Questions 6: Potential Users of the Mobile Service

First, the participants felt that the target users would have a neutral experience with existing services. They believed that the lengthy process involved in searching the archives for data can be intimidating. Additionally, they suggested that users may have a negative experience with online services and social media. They proposed the targeted age group would be users in their 60's and felt they needed to design the service so that it would remove these barriers, (promote the positive aspects of online services). They implied that the users could have a mediocre performance using the service. They felt the user would understand how to use the service, but would need instructions. Furthermore, they suggested that the users may not have much experience with the features of the mobile service, but they intended to adopt best practice in design to ensure the service is intuitive and easy to use.

M-CAI Question 7: Environmental Factors that impact Use of the Mobile Service

The participants suggested the user will get a prompt when passing a landmark and reading may be restricted by lighting. They indicated that the lighting situation will be facilitated by hardware and that some phones, e.g. iOS and some Android phones will facilitate this. In addition, they suggested that the user would most likely upload their stories when at home with minimal distractions. Therefore, little attention would be required. The participants agreed they could not find a scenario where the user would be physically restricted and the

typical user scenario would be compatible with all situations. They also suggested that the current user awareness of the concept was low. At this stage they had no specific strategy in place and planned to work on this in the coming weeks. Finally, they suggested that they did not want to include social media components in the service as they felt the target user group could have a negative perception of social media. However, they felt they could create a strategy to drive social influence, for example, via advertising, word of mouth, recommendations and so on. The participants discussed this aspect in detail and suggested that they may revise their target market and target younger users such as history students. They acknowledged that this was an element they would have to revise at a later date.

Question 8: Advantage of New Service over Currently Exiting Services

This new service would ensure that historic information was more readily accessible in terms of uploading and reading historic stories.

M-CAI Question 9: Urgency of the task

Finally, for question nine they advocated that the service was 'non-urgent' as it is a leisure service.

Table 5.8 Defining the Context of Use

Factors		Q	S	Description
User Factors	**Users Previous Experience**	6 (a)	50	The users have a neutral experience with existing services. E.g. national archival records. May also have negative experience with online services and social media.
	User Accessibility and Access Barriers	6 (b)	55	The user-base, ('older users'), may be slightly uncomfortable using the service - may not be tech savvy. They will know how to use the app, but with instructions. Targeted age group, (50-60).
		6 (c)	55	The user will have to work moderately hard to accomplish the goals of the task. A lot of features – not much experience.
		6 (d)	50	It is likely that they can become stressed when using this form of technology. Possibly have features where buttons will enlarge for those with poor eyesight.
	Users Risk Aversion	6 (e)	N/A	This question is non-applicable as no personal information is required.
External Environment Factors	**User Situation**	7 (a)	55	Lighting, Outside vs Inside. User gets prompt when passing landmark will need to facilitate lighting in 'bright-spaces'. Some lighting situation will be facilitated by hardware, e.g. iOS and some Android phones will facilitate this but others may not.
		7 (b)	85	Distractions outside so content is restricted to very short snippets of information and notifications. Mostly using the app indoors, (at home), therefore the service is compatible for these situations.
		7 (c)	85	No scenario where they would be physically restricted.
	Awareness of the Service	7 (d)	20	Nothing in place at the moment, don't want to involve social media.
	Social Influence	7 (e)	60	There may be an element of social pressure – word of mouth – people recommendations. Will not be connected to social media – as the target user group are not likely to be on social media– maybe target group might be revisited.
Technology Factors	**Relative Advantage**	8	90	More accessible both in terms of uploading and reading information in contrast to existing methods. E.g. the national archives.
Task Factors	**Urgency of the Task**	9	55	Non urgent – this is a leisure activity.

Based on the scores allocated to each question the M-CAI calculated the 'potential user adoption' and illustrated it in the 3D graph, Figure 5.2. The potential adoption score for the mobile concept was 63.43 % that indicates that the mobile service concept fitted into the category high intention to adopt'. A high adoption score indicates that potential users are likely to have high intention to use the mobile service.

Figure 5.2 CS2 Potential Adoption
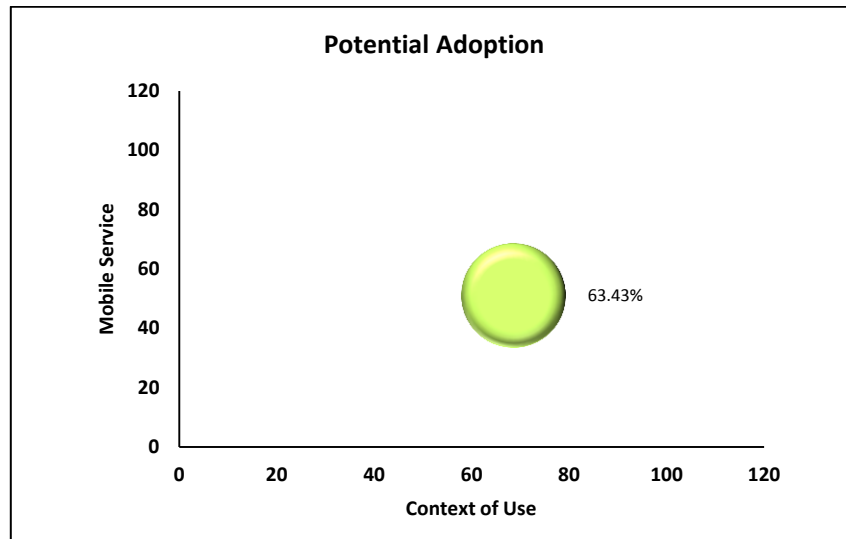
Once the assessment was complete, the participants reviewed their adoption score. In this case the mobile concept is slightly above 60%, which indicates there is potential for the service to be adopted. However, as their score was just above the 60% certain other factors should be considered. For example, the M-CAI highlighted specific factors with the lowest scores which require further attention. These factors were then discussed by the participants.

5.3.4 Data Analysis and Findings

The approach to analysing the data outlined in chapter two, (section 2.3.5), was followed. The corroborated themes are summarised in Table 5.9. This table includes each of the themes present in the data, (including subordinate themes), and the number of references each theme received from the various data sources in CS2.

Table 5.9 CS2: Corroborated Themes

THEMES	PO	D	FN	P7	P8	P9	T	Total
COMMUNICATION	0	0	4	2	1	3	1	11
Information Exchange	0	0	1	3	1	1	0	6
Engaged Exchange	0	0	3	2	1	0	1	7
Integrated Exchange	0	0	3	2	1	0	2	8
Quality of Information Exchanged	0	0	0	3	0	2	0	5
Complete Information	0	0	0	2	0	1	0	3
Consistent Information	0	0	1	2	0	1	1	5
Relevant Information	1	1	3	2	0	2	1	10
								55
TRANSPARENCY	0	1	2	3	4	5	1	16
Structure	1	1	2	2	4	3	1	14
Activity Structure	0	0	0	2	3	1	0	6
Structure of the M-CAI	0	0	1	1	2	0	0	4
Thoroughness	1	0	1	1	4	1	1	9
								49
UNDERSTANDING	1	0	4	7	3	4	1	20
Guidance	1	0	2	4	1	2	0	10
Simplification	0	0	0	7	1	1	0	9
Understanding of Roles	0	0	0	3	2	0	0	5
Understanding of the Mobile Concept	1	0	3	5	4	4	1	18
Consistency	1	0	2	1	0	1	1	6
								68
RATIONAL CHOICE THEORY PERFORMATIVITY	1	0	4	0	0	1	1	7
Barnesian Performativity	0	0	0	0	0	1	0	1
Effective Performativity	0	0	1	0	0	0	0	1
Generic Performativity	1	0	4	0	0	0	1	6
								15
USER EXPERIENCE	0	1	0	4	1	0	0	6
Ease of Use	0	0	0	1	1	1	0	3
Value	0	0	1	3	3	4	0	11
Efficiency	0	1	1	1	1	3	0	7
Usefulness	0	0	1	2	3	3	0	9
Appropriateness	0	2	1	4	1	3	1	12
								48

I.   Communication

Communication and its subordinate themes have been referenced 55 times as summarised in Table 5.9. There are two second order themes captured under communication: 'information exchange' and 'the quality of information exchanged'.

Information Exchange: The data suggest that the exchange of information was more integrated. One participant suggested that having used the M-CAI they specified more aspects of the mobile concept as opposed to typical informal meetings where discussions may not be so in-depth Appendix K (P7, L21). This is supported by another participant who suggested

that the M-CAI facilitates a more integrated exchange of information as discussions were more open Appendix K (P8, L22). The data also indicated that participants were more engaged when exchanging information during the innovation activities Appendix K (P7, L23). Arguably, the M-CAI encourages participants to engage more as a team and collectively agree on the specification and definition of the mobile concept. The field notes also suggest that participants were engaging with each other during the innovation activities Appendix K (FN, L24).

Quality of Information Exchanged: data describes the information exchanged in the innovation process as: consistent, relevant and complete. The design engineer suggested the M-CAI encourages the exchange of consistent information Appendix K (P7, L25). The M-CAI includes consistent terminology which facilitates discussions in the innovation process. Further evidence to suggest that the information exchanged was consistent was found Appendix K (P9, L26; FN, L27; T, L28, P7, L29). This implies that the M-CAI ensured the information exchanged by the participants was consistent. The participants had diverse backgrounds and the M-CAI provided them with a common context that includes clear explanations, definitions and examples. Therefore, when defining the mobile concept the participants were using consistent terminology.

The information exchanged is described as complete. The data suggest that the M-CAI altered 'completeness' of the information exchanged Appendix K (P9, L30). Some factors may have been ignored in the past, and participants may not have previously specified all factors included in the M-CAI. Consequently, using the M-CAI in the innovation process can ensure that information is more complete. The design engineer agreed that information was more complete and that important factors were not forgotten Appendix K (P7, L31; L32). The information exchanged was also described as relevant as it includes necessary information for participants to define their mobile concepts. The project manager suggested that discussing this relevant information in the early stages could prevent problems in the next stage - if they were to proceed without specifying and defining these key components Appendix K (P9, L33).

II.   Transparency

Transparency and its subordinate themes have been referenced 49 times as summarised in Table 5.9. In this case there were two second order themes captured under transparency: 'structure' and 'thoroughness'.

Structure: describes both the structure of the activities in the innovation process and the structure of the M-CAI. One participant implied that the act of defining the mobile concept was more structured Appendix K (P7, L35). While some factors were already specified the approach was more structured after using the M-CAI. The data suggest that the M-CAI provides a step-by-step procedure thereby making activities in the early stages clearer Appendix K (P8, L36). As a result, participants were more aware of the concept definition and evaluation activities. Further inspection uncovered the informal nature of the participant's innovation activities, which resulted in problems showing up in the later development stages Appendix K (P9, L37). The participant's suggested that the M-CAI acts as a 'checklist' and helps prevent these problems Appendix K (P9, L37; P7; L38; P8, L39). The data suggest the layout of the M-CAI was well organised and the categories and scales helped to describe their mobile concept Appendix K (P7, L40; FN, L41). This suggests the M-CAI linked the mobile concept and its potential adoption and made this information more transparent to the participants.

Thoroughness: as questions in the M-CAI are more comprehensive than what is usually considered the mobile concept was more thoroughly defined before proceeding to the next stage. For example, the data described the activities in the innovation process as 'thorough' following the use of the M-CAI Appendix K (P9, L42; P7, 43; P8, 44).

III.   Understanding

Understanding and its subordinate themes have been referenced 68 times as summarised in Table 5.9. There are two second order themes captured under understanding: 'simplification' and 'guidance'.

Simplification: refers to the impact the M-CAI had on the participant's comprehension of the mobile concept and of each other's roles. Therefore, this was broken down into: understanding of the mobile concept and understanding of roles.

In terms of 'understanding of the mobile concept' one participant suggested that the M-CAI simplifies the act of defining the mobile concept, thereby making it less complex Appendix K (P9, L46). They suggested the M-CAI removes the complexity of the activities in the innovation process, making it harder to forget important aspects of the mobile concept which should be defined. Therefore, it would be less likely to be refined in the later stages Appendix K (P9, L45, L46; P7, L47). This was broken down further into a third order code: "consistency". Consistency refers to the participants' understanding of the mobile concept. Having used the M-CAI the participants suggested the information discussed and terminology

used was consistent. This resulted in a consistent understanding of the mobile service by a diverse group of participants Appendix K (P9, L48).

Based on the case study evidence the 'understanding of roles' becomes clearer after the use of the M-CAI. For example, one participant suggested they should define the mobile concept as a group exercise using the M-CAI to get a better understanding of each other's view. They stated that they were more aware of the concept definition activities and the importance of specifying the influencing factors when defining the concept Appendix K (P7, L49). The data also suggested that the M-CAI helped shed light on the decision makers responsibilities when determining whether or not to continue with the project Appendix K (P8, L50).

Guidance: in addition to 'simplifying' the innovation activities the data suggested that the M-CAI 'guided' the participants and therefore supported them when defining and evaluating the mobile concept Appendix K (P7, L51). While defining the mobile concept a wide array of aspects can be disputed which leads to slow and unsure decision making. However, it was agreed that the M-CAI maintained focus and guided participants through the process of defining the mobile concept using the mobile service and context of use questionnaires Appendix K (P9, L52).

Rational Choice Theory, (RCT), Performativity

RCT Performativity and its subordinate themes have been referenced 15 times as summarised in Table 5.9. In this case, there are two second order themes which explain RCT performativity: 'Generic performativity' and 'Effective performativity'.

Generic Performativity: implies that that the core concepts of Cabantous et al. (2010) theory have been enacted in practice. The data demonstrated the participants categorising and quantifying the factors which best described their mobile service. It demonstrated them calculating the potential adoption of their service based on the scores allocated to each of the categories in the M-CAI Appendix K (T, L53; FN, L54). Consequently, the concepts 'contextualisation, quantification and calculation' have been enacted in practice through the use of the M-CAI.

Effective Performativity: implies that that the core concepts of Cabantous et al. (2010) theory enacted in practice 'makes a difference' to the innovation process. This has been traced in the data as field notes suggest that the participants felt that the mobile service was more defined and the information generated was beneficial Appendix K (FN, L55). This information may not have been specified until much later in the project if the M-CAI was not used. At the end of the exercise they stated they will reconsider their target users, thereby

indicating that the core concepts of Cabantous et al. (2010) theory has made a difference to the innovation process Appendix K (FN, L55). While references to Barnesian performativity have been made, it was not traced in this study. However, it may be possible to trace it in future investigations as the participants indicated that the M-CAI is valuable Appendix K (P9, L56). Evidently, the M-CAI has the potential to become integrated into the organisation's decision making routines.

User Experience

UX and its subordinate themes were referenced 48 times as summarised in Table 5.9. There are two second order themes captured under UX namely: 'ease of use' and 'value'.

Ease of use: Several references to ease of use were traced in the data as the participants agreed little effort required to use the M-CAI Appendix K (P7, L57; P9, 58).

Value: the evidence suggested using the M-CAI helped define the concept in detail, which prevents having to refine the concept later Appendix K (P9, L59). In addition, the data suggested that the M-CAI could identify faults with the concept leading to its refinement prior to the design stages thereby making it more cost effective. Therefore the M-CAI supports the business challenge of defining and evaluating mobile concepts in the innovation stages Appendix K (P9, L59). This is broken down into two third order themes - 'usefulness' and 'efficiency'.

Efficiency is the ability of the participants to achieve their goals, (concept definition and evaluation), with the least amount of resources expended in time and effort. The data suggested using the M-CAI to define and evaluate the mobile concept saves time by assisting with 'scoping' the idea for the application. Therefore, time is not wasted on ideas which may not be realistic Appendix K (P7, L60). Further case study evidence suggested problems which arise in the later stages can be effectively dealt with by clearly specifying the concept in the early stages Appendix K (P9, L61). Additionally, the M-CAI can improve the efficiency of the process by going through the 'checklist' and can save resources in the later stages to refine the concept Appendix K (P9, L62).

Usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989). The design engineer and project manager suggested the M-CAI is useful and appropriate for the innovation process as it allows them to consider the concept in detail before the design stages Appendix K (P7, L 63, P9, L64). This indicates the 'appropriateness' of the M-CAI for the innovation stages therefore, the theme 'usefulness' was broken down into a 4th order theme: 'Appropriateness'. The field notes

suggested that the M-CAI was appropriate for the innovation process as it highlighted aspects of the mobile concept needing further attention. Regarding this case the M-CAI led participants to reconsider their target users. The participants agreed this was the appropriate time to address the issue and prevent the concept from being refined in later stages Appendix K (P7, L65-67; P8, L68).

5.4 Case Study Three (CS3)

This study was carried out in a large public organisation based in Dublin, Ireland. This organisation has over 110 offices nationwide, employing over 5700 people. They provide a wide range of services to business and individual persons. These services are available online and through mobile platforms including iPhone, (iOS), Android and Windows. This research focuses solely on their mobile services. New legislation introduced by the government in 2013 resulted in a perfect opportunity for this case study as a new 'work and payments transaction mobile service' was being created. Two members from their mobile application development team participated in the study, which included an IT project manager and a Live Services manager.

5.4.1 CS3 Mobile Service Innovation Process

Their process for mobile service innovation was described as 'structured'. Evidence revealed that the mobile applications they create usually stemmed from changes in legislation. This requires existing services to be altered and/or for further elements to be added-on. For example, participant 10 stated:

"Mainly the concepts for our services come from changes to legislation… when a legislative change is made we have to reflect that in the services which are available to the public online and on-mobile, this could include altering or adding-on features to existing services"

(Participant 10)

They suggested that newly introduced legislation could also result in new mobile services being created. First, they gather the legislative requirements to comprehend what the service should include. Following this they generate ideas to anticipate the mobile version of the service. They described this as an iterative process which involves reviewing existing services to ensure they are consistent. For example participant 11 suggested:

"…we would find out what the legislative requirements are for the service and then consider some ideas, but we always need to ensure that we have consistent services, for example … that the mobile version will have the same look and feel as the web-version, so it will not be completely new for the customers using our other services".

(Participant 11)

Following this, their initial ideas for the mobile version of the service are passed to higher management for signing off. Further requirements are then rationalised and possibilities for the mobile service are scoped. At this stage the functions of the service are specified and initial wireframes created. This is repeated until a comprehensive blueprint is completed. For this specification to be signed-off a series of assessments must be carried out. These include a UX and risk assessment. For example, participant 11 stated:

"There is a series of evaluations that we would make… for example, the user experience is very important, we are aware that the public or the 'users' of our service are diverse and therefore we try to cater for all … we aim to ensure that information used is effective… that the flow of the service is intuitive".

(Participant 11)

If the concept is approved they then proceed to the design and development phase. For example participant 10 suggested:

"We would review those as a group with management here in the business side and then once we get an agreement on that, we would then go and start to design and develop the mobile application".

(Participant 10)

Overall CS3's innovation process is categorised as structured. They have formal activities, which must be 'signed-off' throughout the process. Even though the participants in the study are senior management in the department and are responsible for the creation and management of the service there is also an additional top management board that reviews and approve/reject the service before it is developed and published online. The activities in their process are planned, controlled and regulated.

5.4.2 CS3 Mobile Concept

A 'Mobile Work and Payments Transaction Service' was proposed for assessment. A new national scheme was introduced in Ireland, which provides Government support to members of the public who availed of construction services provided by companies and private individuals. The organisation must create an online and mobile service for those seeking to avail of the scheme. The aim of the service is to record transactions for review by the organisation so that they can approve or disapprove the award of Government supports under the scheme. The service will require two users to create a profile, a) the construction

service provider, and b) the construction service recipient. Once a profile is created by both users the service will then be used to monitor and track all transactions such as work and payments made between the construction service provider and the construction service recipient. When all transactions are recorded the organisation will evaluate the information and determine whether the service recipient is entitled to Government support based on the information provided. While the objective of the concept is to facilitate construction service recipients the service is also convenient for construction service providers as it will enable them to record payments on-site.

5.4.3 CS3 M-CAI Implementation and Data Collection

This section documents the implementation of the M-CAI in the innovation process in CS3 and its use by the participants to assess their mobile concept, ('Mobile Work and Payments Transaction Service'). The data collected from CS3 amounted to a total of 63 pages of qualitative data and was stored in the case study, (NVivo), database for analysis. The implementation and use of the M-CAI is now reported.

The participants selected the category 'transaction service' from the drop down list as this category best described their mobile concept, (mobile work and payment transaction service). Table 5.10 summarises the scores allocated to each question relating to mobile service characteristics and the rationale behind it.

M-CAI Question 1: Trustworthiness of the Mobile Concept

The participants suggested that their service would be 'very trustworthy'. They agreed that security was the most important factor to consider as the service will process sensitive public information. For example, identification reference numbers, addresses, PPS numbers, bank account details, etc. They proposed to appoint certain team members to ensure the security of customer data following the organisation's best practice and standards. They implied they have a strong reputation for achieving this.

M-CAI Question 2: Complexity of the Mobile Service

They suggested the two main use scenarios would require little mental activity. The first scenario would involve creating profiles and the second is entering the specific work and payment information for review. While it is important for the user to enter accurate information the interaction is uncomplicated. The participants suggested a low amount of physical activity is required to use the service, as it involves a minimum amount of steps. In

addition, participants suggested that a time-out function would be included for security purposes. However, the user would have enough time to complete their task.

Table 5.10 Defining the Mobile Service Factors

Factor/Area to focus on	Q	Score	Description
Trustworthiness	1 (a)	95	The service will be very trustworthy as customer information is always of most critical importance. Specific members of the department will be responsible for ensuring that the service is secure. The reputation for this is very good as there has been little/no incident to date.
	1 (b)	N/A	This question is not applicable for this service.
Service Complexity	2 (a)	55	The user will ensure that the information inputted is accurate and overall there is very little mental activity required to use the service.
	2 (b)	70	Input and interaction from the user is required, e.g. form fill-in, selecting confirmation, etc. however, the overall aim is for a minimum no. of steps to use the service.
	2 (c)	70	The time-out function will be 30 minutes for security purposes; however, this is sufficient time for the user to complete their task and therefore should not cause frustration.
Convince & Availability	3 (a)	59	Available online-on-desktop and on iOS, Android and Windows mobile.
Service Information Quality	4 (a)	90	Very relevant, all information will be aligned with the requirements of the user's task. E.g. construction service recipient will only get information relevant to them and construction service provider will only get information relevant to them.
	4 (b)	90	Information will be updated regularly to ensure that the users have the most recent information.
	4 (c)	60	This will depend on the construction service provider they will be known sources, however their reputation is unknown. Would expect reliable information to be inputted however, cannot be 100% certain that this will be the case.
	4 (d)	95	All information required to complete the task will be provided in a clear and well-defined manner.
Service Intuitiveness	5	80	The service will be intuitive and involve minimal interaction.

M-CAI Question 3: Availability of Mobile Service for Potential Users

They suggested that the service would be available on most platforms such as iOS, Android and Windows, which are considered to have the largest user base in Ireland. While some users may access the service from a desktop they believed it would be mainly accessed when the user is mobile, (from a mobile platform).

M-CAI Question 4: Quality of Information Provided by the Service

First, they suggested that the service will provide relevant information. The construction service provider's menu screen will set out the data needed by the construction service provider to input works and/or payments. In contrast the service recipient's menu screen will include the data needed by the service recipient to monitor, track and confirm works and/or payments. Additionally, the content, (instructions), will be updated regularly to ensure users have the most recent information. For example, if the content of the service was altered to reflect any legislative changes. While the information will be obtained from a known source the reliability of the data cannot be guaranteed. This depends on the user inputting reliable information. They predicted that based on data entry with existing services up to 60% of the information inputted would be reliable. Finally, they suggested that all information necessary for the user to complete their task will be of sufficient depth and breadth.

M-CAI Question 5: Intuitiveness of the Mobile Service

They described the service as 'usable' and suggested that its design would be sensible, learnable, guessable and trainable. Overall, they felt that the service would be very straight forward and relatively easy for the user to grasp.

Next, the participants used the M-CAI to define the 'context of use' characteristics that best describe their concept. Table 5.11 summarises the scores the participants allocated to each question and their rationale.

The participants suggested that the customers would not have any experience with this type of service as the service is being created to facilitate 'new' legislation. Consequently, they felt the first part of this question was not relevant to their service and marked it N/A. Next, the participants suggested that the user would find the service easy to use and will accomplish the goals of the task with little effort. They will ensure the service will cater for users of all backgrounds, for example, for the visually impaired the service would have

screen readers. Additionally, instructions and 'instructional videos' will be provided for the people with minimal experience using mobile services and the service would be easily accessible from the organisation's webpage. They implied that the service will not cause stress or frustration as instructions will be provided and at any stage the user can contact the main office for further help. Finally, they suggested that the target users would be willing to share information with the public organisation as they have a good reputation for safeguarding personal information.

Table 5.11 Defining the Context of Use

Factor	Area to focus on	Q	Score	Description
User Factors	Users Previous Experience	6 (a)	N/A	New legislation means this will be a newly introduced service and that users will not have experience with an existing of similar service, consequently this question is not applicable.
	User Accessibility and Access Barriers	6 (b)	90	Very likely – the service must cater for users of all backgrounds, (people with visual impairments and minimum technology experience), – it will be intuitive and easy to use.
		6 (c)	90	The user will not have to work hard to use the service – very few steps to use the service.
		6 (d)	80	The service should not cause stress or frustration. Instructions will be provided and at any stage the user can contact the main office for further help.
	Users Risk Aversion	6 (e)	90	Strong reputation for safeguarding private and confidential information. Consequently, it is expected that the user would trust the organisation and share personal information required for their application.
External Environment Factors	User Situation	7 (a)	90	It is likely that the service will be used in a 'home environment' e.g. when the construction service provider is on-site at the recipient property. Therefore, environmental factors present are expected to be low and the service should be compatible.
		7 (b)	90	Once again, it is likely that attentional factors present will be low and the service should be compatible.
		7 (c)	90	Once again, it is likely that physical factors present will be low and the service should be compatible.
	Awareness of the Service	7 (d)	85	Very aware – the department responsible for media coverage will create a plan and all information in relation to the mobile service will be available on the organisations main webpage.
	Social Influence	7 (e)	N/A	The service will not be linked to social media, instead the service is provided to facilitate those who wish to avail of the scheme.
Technology Factors	Relative Advantage	8	90	The mobile service will facilitate users completing applications to the scheme at a faster pace than the old style 'manual forms'.
Task Factors	Urgency of the Task	9	60	The task is non-urgent. There will be plenty of time for the users to complete their task.

M-CAI Question 7: Environmental Factors that impacts Mobile Service Use

The participants suggested that the service will be compatible with use situations where environmental factors can impact the use. They discussed several ways they would cater for these environmental factors. However, they felt for the most part, the service would be used in a 'home' environment where environmental factors would not be an issue. They also suggested that they expect the attentional factors present to be low, due to the expected use scenarios. In the event of the application being used in a distracting environment the participants discussed several ways to counteract this. For example, minimum steps required to enter data. They also expect minimal 'physical restrictions', as the user would be in a 'home environment' and would be able to use the service without being restricted. In terms of user awareness, the participants suggested that user awareness would be high. They have a department responsible for the media coverage of all new services which are made available to the public. Additionally, their main webpage is well known in Ireland and is accessed by members of the public on a daily basis. They agreed it would be necessary to published information on their webpage to ensure that the public are aware of the service. They also stated that their service would not be linked to social media and does not pressure the public to use it. Consequently, they marked the 7 (e) as N/A.

M-CAI Question 8: Relative Advantage of Using New Service over Currently Existing Service

The participants implied it would be more advantageous to use this new service as it would facilitate the users to complete their applications and input the 'payment and works' information at a faster pace than 'manual forms' and therefore more convenient.

M-CAI Question 9: Urgency of the Task

They suggested that the service would be 'non-urgent'. The scheme will have a deadline for submissions. However, there would be plenty of time for the users to complete this.

Based on the scores allocated to each question the M-CAI calculated the 'potential user adoption' which was visually represented in the 3D graph shown in Figure 5.3.

Figure 5.3 CS3 Potential Adoption
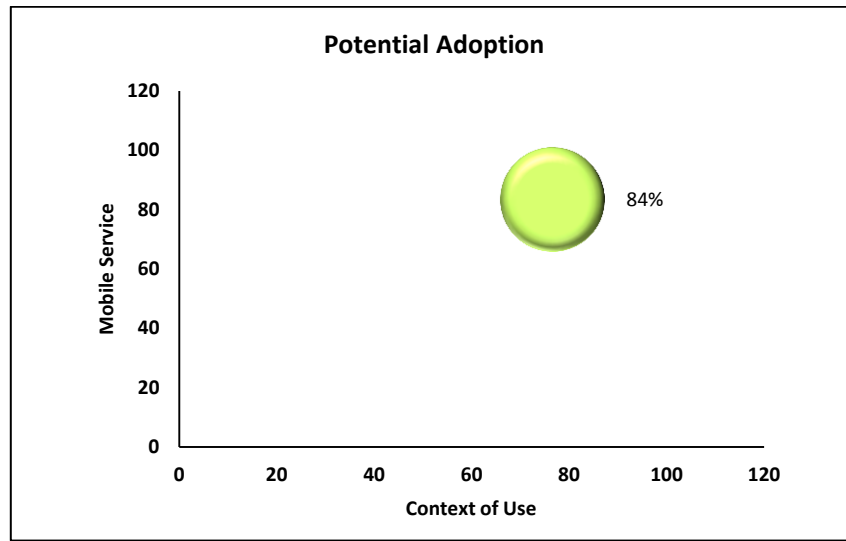
The potential adoption score for this mobile concept was 84% indicating that the mobile service concept fitted into the category: 'high intention to adopt.

5.4.4 Data Analysis and Findings

The approach to analysing the data outlined in chapter two, (section 2.3.5), was followed. The corroborated themes are summarised in Table 5.12. This table includes each of the themes present in the data, (including subordinate themes) and the number of references each theme received from the various data sources in CS3.

Table 5.12 CS3: Corroborated Themes

Themes	D	FN	P10	P11	T	Total
AS A REUSLT OF EXISTING PRACTICES	2	2	6	6	0	16
Communication	0	2	3	3	0	8
Quality of the Information Exchanged	1	2	4	4	0	11
Relevant Information	1	2	5	4	1	13
Consistent Information	1	1	0	2	1	5
Complete Information	1	1	2	1	0	5
Information Exchange	1	1	3	3	1	9
						67
Transparency	1	1	2	4	0	8
Thoroughness	2	2	5	4	0	13
Structured Process	1	1	4	5	0	11
Structured Activities	2	2	5	5	0	14
						46
Understanding	1	0	4	2	0	7
Understanding of the Mobile Concept	1	0	3	2	0	6
Understanding of Roles	1	0	2	2	0	5
						18
AS A RESULT OF THE M-CAI	0	1	5	3	1	10
User Experience	0	0	6	3	0	9
Value	0	0	4	2	0	6
Usefulness	0	0	5	1	0	6
Non- Applicable	0	1	3	4	0	8
Ease to Use	0	0	2	1	0	3
						42
RCT Performativity	0	2	0	0	1	3
Generic Performativity	0	3	0	0	1	14
						17

I. Communication

Communication and its subordinate themes have been referenced 67 times as illustrated in table 5.12. No evidence was found to suggest communication within the innovation process was altered as a result of the M-CAI. Instead, all references to communication and its subordinate themes were linked to the organisation's existing practices. There are two 2nd order themes captured under communication: information exchange and the quality of the information exchanged.

Information exchange: The participants believed the current exchange of information in their innovation process was effective. They implied that if someone misinterpreted or didn't understand the concept, they would ask or the project manager would ensure that they are informed Appendix L (P11, L33). Additionally, they believed they exchanged relevant information necessary to define the mobile concept in a 'structured way'. They implied that this is evident from their long track record of effectively developing services Appendix L (P10, L34). Evidently the structured nature of their innovation process allows them to

communicate clearly. The data suggested that the participants thoroughly defined the mobile concept in the innovation process as they already consider all factors in the M-CAI Appendix L (P10, L35). Furthermore, the data implied that while doing this they effectively exchanged ideas and information about the concept in a formal manner Appendix L (P11, L36).

Quality of information exchanged: The participants implied they already discuss relevant information in the innovation process Appendix L (P10, L37). The data suggested that the information exchanged was also complete. For example, they had a comprehensive discussion in the early stages when defining the mobile concept which included the specification of a long list of factors Appendix L (P10, L35). The data gathered implied that the terminology used by the participants was consistent Appendix L (P10, L38).

II.   Transparency

Transparency and its subordinate themes have been referenced 62 times as summarised in Table 5.12. No evidence was found to suggest transparency within the innovation process was altered as a result of the M-CAI. Instead, all references to transparency and its subordinate themes were linked to the organisation's existing practices. There are two 2nd order themes captured under transparency: 'thoroughness' and 'structured process'.

Thoroughness: the data suggest that the participants already thoroughly define and evaluate mobile concepts in the innovation process. For example, the participants carefully and comprehensively define the mobile concept to ensure it is accessible for all Appendix L (P10, L39, L40). The concept is then assessed by legal advisors and each step is signed off by 'top-management' Appendix L (P11, L41; P10, L42). Once the concept had been thoroughly defined and reviewed it was then approved or rejected by the senior management Appendix L (P10, L43).

Structured Process: The data suggest that the organisation already has a structured process in place. For example, the project manager inferred that they have a set procedure in place to ensure that the service is safe and effective for the users Appendix L (P10, L44). He stated that the activities in their innovation process are structured Appendix L (P10, L45). This was broken down under the 3rd order theme: "structure of activities'. The activities in their innovation process are restricted by legislation and as a result their process reflects this. For example, when defining the concept certain characteristics such as connecting to social media or sharing information cannot be applied as they are restricted by legislation Appendix L (P10, L46). As a result, each activity is carefully conducted in a formal manner before signing off

and moving on to the next activity Appendix L (P11, L36; P10, L43). Therefore the process and its activities are rigid.

III.   Understanding

Understanding and its subordinate themes have been referenced 46 times as summarised in Table 5.12. No evidence was found to suggest understanding was altered as a result of the M-CAI. Instead, all references to understanding and its subordinate themes were linked to the organisation's existing practices.

The data suggested that the participants had a good understanding of the key decision elements as reviewing the adoption information they implied they already consider these factors Appendix L (FN, L47). Therefore the participants already had a good understanding of these elements and the M-CAI did not add to this Appendix L (P10, L31). The data implied if they misinterpreted the mobile concept this would be clarified Appendix L (P11, L33). As this refers to the participants' understanding of the mobile concept this was broken down into the 3rd order theme 'understanding of the mobile concept'.

While referring to the 'understanding of their roles' the project manager indicated that the innovation process and the team's responsibilities were transparent Appendix L (P10, L34, L44, L45). This indicated that the participants were aware of their roles and responsibilities within the process. The live service manager also suggested that the exchange of information was good and that the participants had a good understanding of their roles and responsibilities Appendix L (P11, L33).

Rational Choice Theory, (RCT), Performativity

RCT Performativity and its subordinate themes have been referenced 17 times as summarised in Table 5.12.

Only evidence of 'generic performativity' could be traced in the data. For example, the template data indicated that the participants allocated scores to the specific characteristics which define their mobile concept and its context of use. Consequently, the core concept 'contextualisation' was enacted in practice through the use of the M-CAI. This is backed up as the data suggested that the participants selected the 'type of mobile service' from the drop down list of categories, allocated scores to the categories which best define their service, and calculated a potential adoption score Appendix L (FN, L19). As a result, the concepts contextualisation, quantification and calculation have been enacted in practice through the use of the M-CAI.

User Experience

UX and its subordinate themes were referenced 42 times as summarised in Table 5.12. There are two second order themes captured under UX namely: 'ease of use' and 'value'.

Ease of use: The participants described the M-CAI as 'user friendly' and 'easy to use' which suggests little effort is required to use it. For example, the live services manager implied that it may require trial and error, however, overall he felt that the M-CAI was not complicated Appendix L (P11, L22). Similarly, the project manager implied that use of the M-CAI required little effort Appendix L (P10, L23).

Value: This is the extent to which the M-CAI supports business needs and challenges. The participants implied they could see the value in the M-CAI Appendix L (P10, L24). Regarding this case the participants felt the M-CAI was not applicable for their organisation's innovation process due to the nature of the services they create, (e.g. public service) Appendix L (P11, L25). Despite this they felt the M-CAI would be useful for concept definition and evaluation, particularly the questions and categories structured in the M-CAI Appendix L (P10, L26; P11, L27).

As the M-CAI was also described as useful, this has been broken down into a 3rd order theme 'usefulness'. The data suggested the participants found the questions in the M-CAI useful when defining the concept Appendix L (P11, L28). Furthermore, the data suggested the M-CAI is useful where others outside the team may be involved as they may not be familiar with ongoing activities and the M-CAI could help guide them Appendix L (P11, L29). While the participants deemed the M-CAU useful the legalised nature of their innovation process lead them to believe it was not applicable for them Appendix L (P10, L30, L31). As a result, this theme was broken down further into a 4th order theme, - 'non-applicable'. As the services are expected to meet the estimated adoption therefore adoption is not a key decision element in this case. As a result, investment into the M-CAI may not be applicable for their process. Additionally, the rigid legal nature of their innovation process means using the M-CAI may not be appropriate as it would be difficult to alter their process Appendix L (P11, L32).

5.5 Chapter Summary

This chapter described the evaluation of the M-CAI's impact on the front end of mobile service innovation. Firstly, the evaluation propositions were specified and the participating case study organisations profiled. Following this, the three qualitative case studies were

reported. Each individual case study provided an account of the organisation, its innovation activities, its participants and the mobile concept assessed by the M-CAI, together with an overview of the implementation of the M-CAI. Finally, the data collection, analysis and individual case findings were presented.

The main findings include: 1) Changing the exchange of information in a positive way by modelling important parameters of the decision which encourage decision makers to discuss key decision elements in a more collective manner resulted in improved communication. 2) Structuring the decision making activities in the innovation process by logically re-arranging decision elements so they can be quantified adds structure to the process and makes the decision making activities more transparent. Overall, this resulted in activities and roles in the innovation process becoming more transparent. 3) Modelling the decision situation simplifies decision making by enabling the decision maker to filter relevant information for their decision which resulted in improvements to the decision makers understanding of key decision elements in the innovation process. 4) Evidence of RCT performativity was also traced. This refers to the theory of crafting rational decisions in practice (Cabantous et al. 2010) influencing the decision making practices in the process for mobile service innovation through the use of the M-CAI. 5) Finally, a positive UX with the M-CAI was traced.

Chapter 6: Cross-Case Findings and Conclusions

This chapter reports on the findings and interpretations of the cross case analysis following the approach outlined in chapter two, (section 2.3.6). Table 6.1 shows the main themes referenced across all three cases. This table is divided into two groups. Group 1 record outcomes traced as a result of the organisation's existing practices and group 2 record outcomes traced as a result of the M-CAI. A total of 894 references was gathered under the two groups. The following five main themes emerged in the data:

1) **Communication:** Integrated and engaged exchange of relevant and complete information to define and evaluate the mobile concepts in the innovation process.

2) **Transparency:** Clearly defining and evaluating mobile concepts in an organised manner using the M-CAI that is monitored and controlled by the team.

3) **Understanding:** Simplification and guidance of concept definition and evaluation where key decision elements are better understood.

4) **Rational Choice Theory Performativity:** The theory of crafting rational decisions in practice influencing decision making practices in the mobile service innovation process via the use of the M-CAI.

5) **User Experience:** User's perception of practical and valuable aspects of the M-CAI that include ease of use, usefulness and efficiency of the system.

Table 6.1 includes the 28 subordinate themes which further explain these five main themes. By drawing on references captured in the data conclusions can be made on the impact of the M-CAI on innovation processes.

Table 6.1 Cross Case Matrix Table

AS A RESULT OF EXISTING PRACTICE	CS3	CS2	CS1
Understanding	14	0	0
Understanding of the Mobile Concept	12	0	0
Understanding of Roles	10	0	0
Transparency	16	0	0
Thoroughness	26	0	0
Structured Process	22	0	0
Structured Activities	28	0	0
Existing Adoption Trends	6	0	0
Communication	16	0	0
Quality of the Information Exchanged	22	0	0
Relevant Information	26	0	0
Consistent Information	10	0	0
Complete Information	10	0	0
Information Exchange	18	0	0
AS A RESULT OF THE M-CAI	**CS3**	**CS2**	**CS1**
User Experience	18	6	8
Value	12	11	12
Usefulness	12	9	6
Non- Applicable	16	0	0
Appropriateness	0	12	8
Efficiency	0	7	7
Ease of Use	6	3	10
Understanding	0	20	16
Simplification	0	9	15
Understanding of the Mobile Concept	0	18	23
Consistency	0	6	6
Understanding of Roles	0	5	14
Guidance	0	10	9
Transparency	0	16	9
Thoroughness	0	9	16
Structure	0	14	20
Structure of the M-CAI	0	4	10
Structure of Activities	0	6	17
Control	0	0	3
Rational Choice Theory Performativity	6	7	11
Generic Performativity	8	6	13
Subjective Probability	0	0	9
Effective Performativity	0	1	14
Barnesian Performativity	0	1	4
Communication	0	11	22
Quality of Information Exchanged	0	5	6
Relevant Information	0	10	7
Consistent Information	0	5	0
Complete Information	0	3	5
Information Exchange	0	6	17
Integrated Exchange	0	8	14
Engaged Exchange	0	7	14

6.1 Cross Case Interpretations and Findings

The five major themes are now discussed under the evaluation propositions together with additional themes that emerged in the data.

6.1.1 Proposition I

Evidence of improved 'Communication' in CS1 and CS2 was traced as a result of implementing the M-CAI. However, there was no evidence traced in CS3. This indicates that the M-CAI altered the exchange of information in the innovation process in both CS1 and CS2 but not in CS3.

CS1 and CS2 participants felt that some team members in their current innovation practice dominate discussions and excluded other members from engaging in defining the mobile concept. They indicated they did not always agree on the concept and usually gave 'yes or no' answers (Appendix J: P1, L26; Appendix K: P7, L23). They found that using the M-CAI enabled all members to mutually agree on the scores (Appendix J: P4, L27). This enabled the team to become more aware of each other's opinions (Appendix K: P7, L23) and encouraged teamwork where each member got their views across (Appendix J: P5, L25). They believed the M-CAI prevents dismissing other's opinions. Based on this it can be argued that the participants were more engaged in defining the mobile concept having used the M-CAI.

The findings from both CS1 and CS2, also suggest the teams' discussions were more integrated when defining and evaluating the mobile concept. The participants specified more aspects than they would in their typical informal meetings. They mentioned it was common for them to forget important elements to be specified in the innovation process Appendix K (P7, L21). In contrast, the M-CAI draws people's attention to factors which may not be considered such as the question on how 'risk averse' the user may be. The participants agreed, this is something no one on the team would have brought up, but it is very important to consider Appendix K (P8, L22).

The M-CAI has impacted the quality of the information exchanged. In particular, the M-CAI has affected the completeness of the information exchanged. For example, the participants suggested that using the M-CAI involves more than a general discussion it requires you to carefully and completely define your concept Appendix J (P1, L29) and Appendix J (P1, L7). They also implied that far more information was generated than usual Appendix J (P3, L28; P4, L30). This indicates that having used the M-CAI the information exchanged is more complete than it would have been under their usual practice.

The findings suggest the information exchanged is also more relevant than what is typically exchanged in practice. They suggested that the M-CAI contains all relevant information required to define the mobile concept (Appendix J P3, L31). For example, when CS2 selected 'information service' as the 'service type' data was filtered so that only relevant adoption

information for 'information' services was presented (Appendix K: FN, L34). The participants suggested that the factors specified in the M-CAI usually would not be discussed until the 'testing' stages and they stated that it would be suitable to consider this information in the earlier innovation stages. Therefore, the findings show that using the M-CAI results in the exchange of more relevant information.

Furthermore, the findings implied the information exchanged was consistent. As participants come from diverse backgrounds with different areas of expertise sharing opinions was difficult due to inconsistent terminology being used. For example the terms 'accessibility' and 'availability' were interpreted incorrectly by the participants. They only realised these were different concepts after using the M-CAI (Appendix K: P7, L25). Naturally a common language makes defining the concept easier and as consistent terminology was used in the M-CAI the information exchanged was therefore more consistent.

The percentage of references to communication as a result of implementing of the M-CAI is illustrated in Figure 6.1. CS1 provides 61% of the references with CS2 making up the remaining 39%.

Communication referenced in CS1 and CS2 was proven to be from the use of the M-CAI and not from the organisations' existing practices. As no evidence was found in CS3 to suggest communication was altered as a result of the M-CAI we now look at this through the lens of existing practices.

Figure 6.1 Communication traced as a result of M-CAI
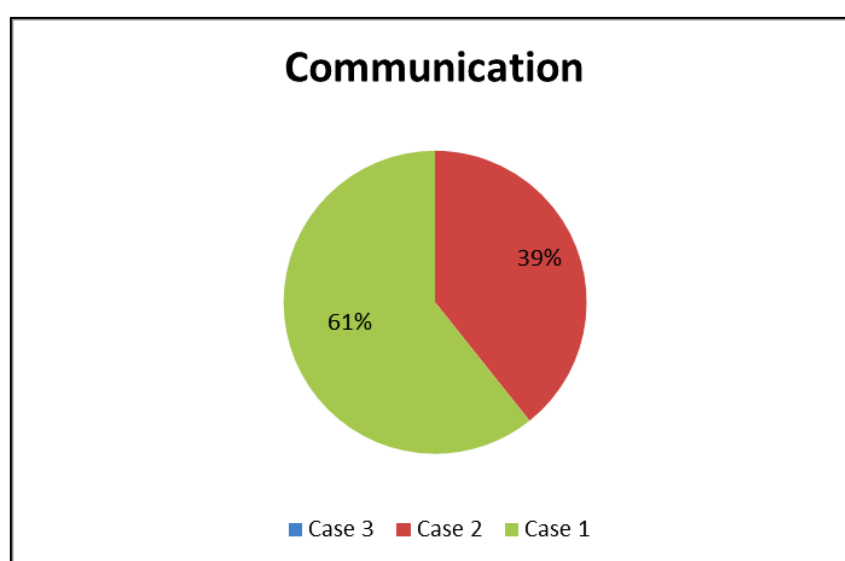
Figure 6.2 illustrates the percentage of references to communication as a result of the existing practices. Only CS3 referenced 'communication' as a result of existing practices, (e.g. 100% of the references). No evidence was found in CS3 to suggest communication was altered as a result of the M-CAI. This is as the findings from CS3 suggested that their exchange of information was already effective. For example, the participants suggested they would always exchange relevant information when defining mobile concepts. They further implied that they already consider all of the factors that are included in the M-CAI Appendix L (P10, L35). This indicates that CS3 thoroughly define concepts during the early innovation stages.

They also implied that the information exchanged is consistent. For example, terminology used in the early stage is consistent and the M-CAI had no impact on that (Appendix L: P10, L38). Furthermore, they stated that if someone did not understand the concept they would ask and the project manager would ensure that they were informed (Appendix L: P11, L33). They advocated that the team were very much engaged when defining the concept. They implied that their long track record of successfully developing and deploying services for the public illustrates that they have an effective process in place and that the M-CAI could not add to this (Appendix L: P10, L30 L31).

Figure 6.2 Communication traced as a result of Existing Practices
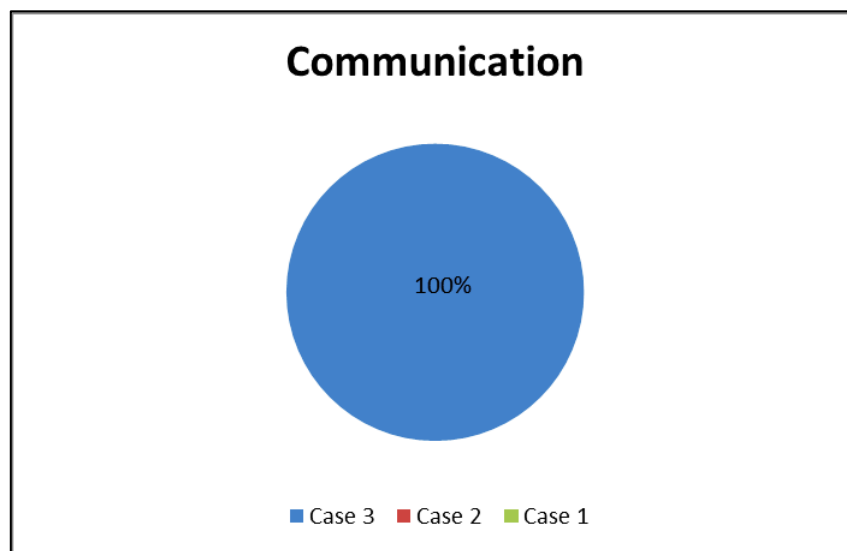
In conclusion, proposition I has been confirmed in CS1 and CS2 and the rival explanation rejected. However, this proposition is not confirmed in CS3 and the rival explanation is not rejected. Therefore the M-CAI can facilitate the effective exchange of good quality information in the innovation process of organisations which share similar profiles to that of CS1 and CS2 thereby providing key information for the decision situation. Evidently, this cannot be claimed for organisations who share similar profiles to that of CS3.

6.1.2 Proposition II

Evidence was traced in CS1 and CS2 to suggest the M-CAI had an impact on 'Transparency' however, there was no evidence traced in CS3 Figure 6.3. This indicates that the M-CAI altered transparency in the innovation process in both CS1 and CS2 but not in CS3.

CS1 and CS2 suggested that questions in the M-CAI ensured the team had a structured and specified list of factors to follow when defining the mobile concept which kept them focused. The participants felt the M-CAI helped them scope the concept from the beginning (Appendix J: P2, L35) and provided the necessary questions and categories to help define the mobile concept (Appendix K: P7, L40). This was particularly evident in CS2 when they originally targeted all users, but after using the M-CAI they felt they may only target students (Appendix K: P7, L47). CS1 and CS2 innovation processes consisted of informal discussions with no set structure therefore they would often veer off topic, for example, they stated that they usually get stuck in the concept definition stage especially when members have different perspectives. As a result, they often jump from topic to topic without any focus and end up with a long list of possible ideas instead of a defined concept (Appendix K: P7, L38). They felt that the M-CAI acted as a checklist for defining the concept and helped them to stay focused (Appendix J: P6, L36).

The participants agreed the M-CAI ensured the concept was more thoroughly defined with the sophisticated list of questions and categories. Based on the categories selected the M-CAI filtered data and presented adoption information relevant only for those categories. Clearly the M-CAI provided a more comprehensive list of items to be specified thus making defining the mobile concept more thorough (Appendix J: P1, L40). The participants acknowledged that this level of detail helped them better understand their concept and define it more effectively (Appendix K: P7, L43; Appendix J: P1, L40, P5, L49). Additionally, using the M-CAI ensured that important factors were specified which may not have been discussed during informal meetings (Appendix K: P7, L10; P9, L30; P7, L31).The M-CAI acts as a step-by-step procedure that provides clarity to the front end activities (Appendix K: P8, L36).

Existing activities in CS1 and CS2 were ill-defined and lacked formalisation and in some instances resulted in too little time allocated to defining the concept. Typically 'early stage' meetings involved informal discussions where they did not have a list of questions or key points pre-prepared for discussion. The M-CAI ensured that participants allocated the appropriate time for defining the concept by requiring them to answer each question. Therefore the M-CAI acted as a step by step guide (Appendix K: P8, L39) and ensured that participants dedicated a 'time and space' to define the mobile concept (Appendix J: P2, L37).

Therefore the M-CAI adds structure to the activities carried out during concept development and participants in CS1 and CS2 also advocated that it added structure to their overall process.

The M-CAI also enabled participants to engage in innovative activities that thoroughly defined and evaluated the mobile concept before the design and development stage (Appendix J: P1, L38). As a result the team became more aware of concept definition and evaluation activities (Cabantous et al. 2010; Gregory, 2012) and consequently the innovation process became more transparent. Perhaps the continued use of this M-CAI will give the team a greater understanding of the process and activities and allow them better understand characteristics most suitable for the type of service being created. The M-CAI produces a potential adoption score that allows identification of the mobile services potential and indicates if the decision makers are making the right choices (Appendix J: P3, L33). For example, it helped to indicate whether a particular characteristic of the mobile concept or its context of use was likely to lower the potential adoption score and therefore needed to be re-considered before moving forward with the project. As a result, one can argue the importance of the M-CAI when evaluating the concept at the front end.

The percentage of references to transparency and its subordinate themes as a result of implementing the M-CAI is illustrated in Figure 6.3. CS1 makes up 60% of the references with CS2 making up the remaining 40%. CS3 made no reference to suggest transparency in the innovation process is as a result of the M-CAI.

In contrast, Figure 6.4 illustrates the percentage of references to transparency as a result of the existing practices. All references as a result of existing practice were traced from CS3.

CS3 participants felt the M-CAI could not add to their current practice as their process was already well structured (Appendix L: P10, L6). Additionally, they confirmed they already specify all factors in the M-CAI (Appendix L: P10, L35). They did not have to think about answers to the question on social media or sharing of information as they are restricted by legislation and cannot therefore alter the scores (Appendix L: P10, L46). Furthermore, they said it was impossible for them to adjust concepts laid down by legislation (Appendix L: P10, L6). This denotes that their process does not allow for the concept to be redefined or adjusted and as it must follow legislative requirements. The concept is also reviewed by legal advisors before it is published online (Appendix L: P10, L42) as the mobile concept facilitates a public service and may contain sensitive information.

Figure 6.3 Transparency traced as a result of M-CAI
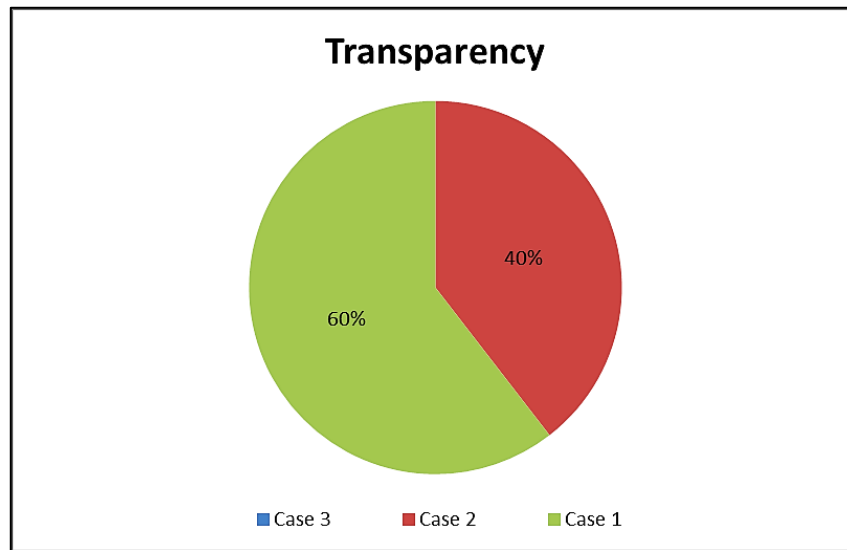
The participants revealed their well-structured process ensures their services are safe for their users (Appendix L: P10, L11). Moreover, they dedicate a lot of time to defining and evaluating the concept and assured they already consider all elements in the M-CAI. For example, as a public organisation they could face serious reputational damage if they did not consider 'security' as a factor (Appendix L: P10, L15). They also felt as they provide a public service they need to be more thorough than most private companies (Appendix L: P10, L15) and as a result all their activities and responsibilities in the process are transparent and vital in providing an effective service for the public. The nature of this public organisation requires a rigid innovation process that adheres to legislative guidelines during concept development.

While CS3 provide transparency and structure to their practice the set nature of their process does not allow flexibility in concept definition in the same way as CS1 and CS2. The mobile concepts in CS1 and CS2 are of a commercial nature and as competition is guaranteed more creativity on the part of the private organisations is expected. Consequently, a less rigid innovation process is necessary and one can argue that implementing the M-CAI structures a more flexible process in private organisations while allowing them the creative space necessary to develop their mobile concepts.

To summarise, existing innovation processes were weak in CS1 and CS2 and issues often unearthed after testing began. Participants admitted they did not spend enough time discussing user requirements and moved into the design stages too quickly. Typically key decision information was not thoroughly specified. Using the M-CAI can add structure, makes activities transparent and help prevent problems in later stages of development as it aids in discussing the concept in depth and highlighting factors before the design stage. Therefore, it

has been demonstrated that transparency referenced in CS1 and CS2 is as a result of the M-CAI and not as a result of existing practice as in CS3.

Figure 6.4 Transparency traced as a result of Existing Practice
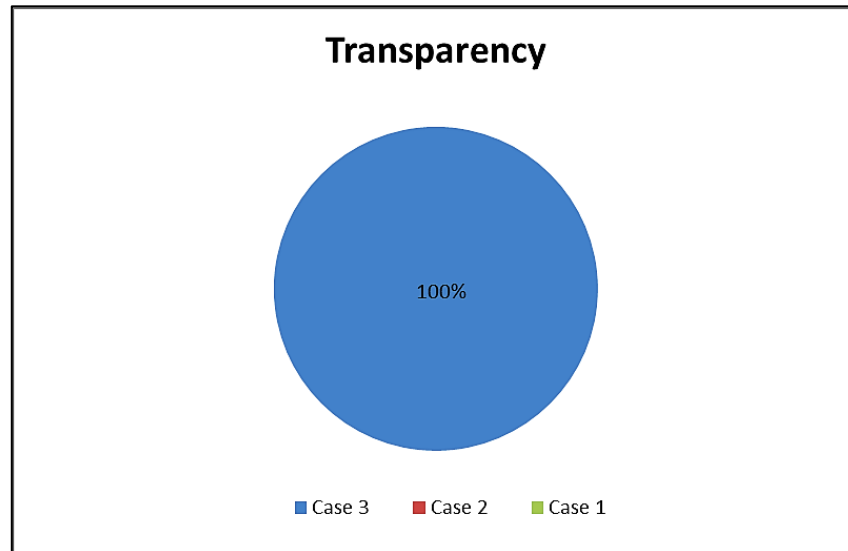
In conclusion, proposition II is confirmed in CS1 and CS2 and the rival explanation rejected, but in CS3 the rival explanation is retained and Proposition II is rejected. Therefore the M-CAI adds structure to innovation processes of organisations that share similar profiles to that of CS1 and CS2 making the decision maker's activities and roles more transparent. However, this cannot be advocated for organisations who share similar profiles to that of CS3.

6.1.3 Proposition III

Evidence of improved understanding due to use of the M-CAI was traced in CS1 and CS2, however, there was no evidence of this traced in CS3. This indicates that the M-CAI altered understanding in the innovation process in both CS1 and CS2 but not in CS3.

CS1 and CS2 participants suggested the M-CAI made it easier to define the concept by illustrating alternative characteristics that describe the mobile concept and the context of use (Appendix J: P1, L44). In addition the M-CAI provides the means to examine the consequences of choosing the various characteristics (Appendix J: P1, 11). The list of questions, categories and potential adoption illustrated in the M-CAI provides the participants with a better understanding of key decision elements. For example, if they defined the service as having 'high complexity' this could result in a low adoption score as high complexity can negatively influence adoption. By illustrating this the M-CAI can influence the participant's choice to change a particular aspect of the mobile concept or its context of use to increase

potential adoption. One example was seen in CS2 when they discovered that they need to reconsider the targeted users as their negative experiences with online services may impact adoption. As a result, when promoting the service they aim to remove negative associations users may have with the service and reconsider the target users (Appendix K: P7, L47; FN, 55, P9, L46). CS2 indicated that if they did not use the M-CAI they may not have considered this until a much later stage (Appendix K: P7, L47; FN, 55).

The findings also suggested that the M-CAI helps shed light on the decision maker's roles and responsibilities in the innovation process. After using the M-CAI each member better understood the roles and the responsibilities of their team members (Appendix J: P2, L45). For example, CS1 discovered that 'user awareness' would need further consideration and that marketing plays a far larger role in the project than previously anticipated (Appendix J: FN, L16). This prompted them to further consider marketing's input into the project, which was something they would not normally have considered until much later in the project (Appendix J: P2, L63, L66). They budgeted more for the design and development stage than for marketing for user awareness (Appendix J: P2, L46). Based on this one can argue that the M-CAI can assist the management of activities in the innovation process by improving understanding of roles and responsibilities. As the concept becomes clearer resources, roles and responsibilities necessary for its creation become apparent, thus making it easier to manage the project and delegate tasks to relevant individuals. Therefore, it can be argued that the M-CAI can assist with the effective management of up-front activities in the mobile service innovation process.

The M-CAI also 'guides' and supports the team members in defining and evaluating the mobile concept. For example, in CS2 normally there is no set concept definition or evaluation procedure and they often waste time defining concepts with many aspects disputed (Appendix K: P7, L51). As a result, they can misinterpret each other or forget to specify important factors. CS1 also revealed that these activities were usually conducted on an ad hoc basis and they define the concept during informal conversations (Appendix J: P3, L65), leading to slow and unsure decision making. However, the M-CAI helped them to maintain focus as it guides them through the process of defining the mobile concept with the list of reference questions (Appendix K: P9, L52). Going into a meeting without a list of questions like those in the M-CAI could result in lost ideas. The M-CAI forced them to discuss these items in more depth and therefore allocate the team members responsibilities accordingly (Appendix J: P1, L26).

CS2 suggested their activities were informal and they often only see the issues after implementation and testing (Appendix K: P9, L37). They stated that using the M-CAI as a

checklist they may save on resources normally used later to solve issues that could be identified earlier (Appendix K: P9, L37). Therefore, the M-CAI acts as a guide in ensuring that key decision elements are discussed (Appendix J: P5, L51).

The M-CAI allows for a systematic examination of the mobile concepts characteristics and highlights the potential adoption based on these characteristics. Arguably, as the team continues to use the M-CAI they become more aware of what characteristics are most fitting for a particular type of service. Consequently, their understanding of each element becomes more acute and their process more formal.

The percentage of references to 'understanding' as a result of the M-CAI is illustrated in Figure 6.5. CS1 accounts for 55% of the references with CS2 making up the remaining 45%. It is evident that the change in 'understanding' in CS1 and CS2 was as a result of the M-CAI. However, there was no evidence found in CS3 to suggest that understanding was altered as a result of the M-CAI.

Figure 6.5 Understanding traced as a result of M-CAI
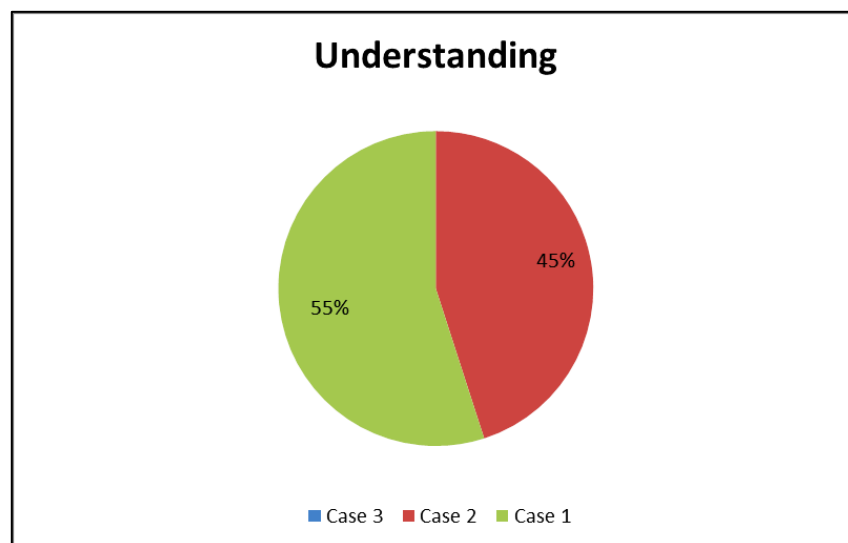
In contrast, Figure 6.6 illustrates the percentage (100%) of references to 'understanding' as a result of existing practices. The CS3 data shows that they already had a good understanding of key decision elements. After categorising their concept and reviewing adoption information using the M-CAI they implied they already consider these factors in their current process (Appendix L: FN, L47) and therefore, the M-CAI could not add to this. They also stated their current activities ensure that they have a very good understanding of the mobile concept and if the team misinterpreted one another or did not understand the concept it would be clarified (Appendix L: P11, L33). This is evident when they implied that some questions in the M-CAI would be obvious, such as information quality, as it is one of the first things they consider

when creating public services, and it is imperative to have a good understanding of these (Appendix L: P10, L37).

**Figure 6.6 Understanding traced as a result of Existing Practices**
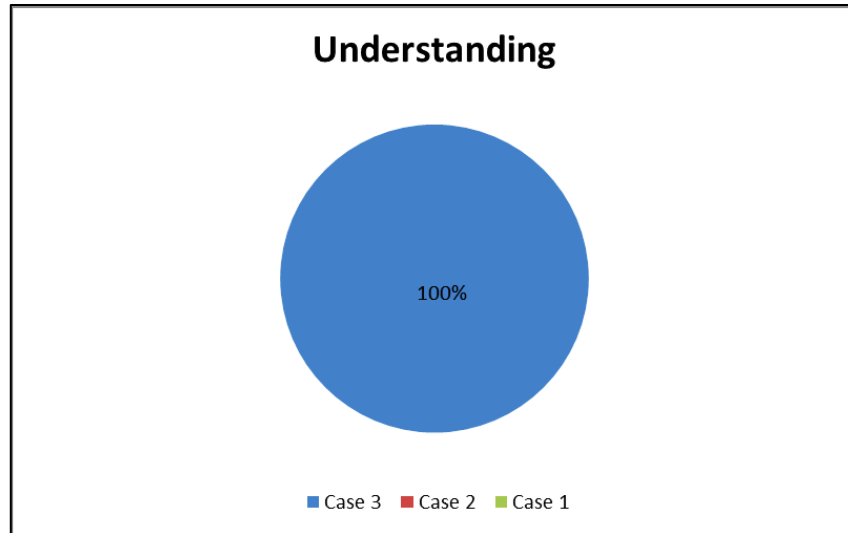
In conclusion, proposition III was confirmed in CS1 and CS2 and the rival explanation rejected. However, in CS3 the rival explanation is retained and Proposition III is refuted. The M-CAI can help simplify decision situations in organisations which share similar profiles to that of CS1 and CS2 and improve the decision makers understanding of key decision elements. However, this cannot be suggested for organisations who share similar profiles to that of CS3.

6.2 Additional Themes to Emerge from the Data

References to RCT performativity and User Experience were also traced across the three cases Table 6.1.

6.2.1 RCT Performativity

Evidence of RCT performativity has been traced in all three cases, Figure 6.7. This theme was broken down further into 'generic performativity' and 'effective performativity'.

Generic performativity refers to the mobilisation of the core concepts, (e.g. contextualisation, quantification and calculation), of Cabantous et al.'s (2010) theory in practice. This is apparent in all three cases as the as participants selected the categories which best define the mobile concept and its context of use. The core concept 'contextualisation' has been enacted in practice through the use of the M-CAI as participants selected the key decision items relevant for them. The teams also allocated relevant scores to each of the

categories. A potential adoption score was calculated and reviewed by the team. This is the quantified adoption relevant for this particular group of services (Appendix J: FN, L53; Appendix K: T, L53; FN, L54; Appendix L: FN, L20-21). Evidently the M-CAI has enabled the effective mobilisation of the previously quantified adoption through functions used in an Excel spreadsheet. Based on this one can argue that the concepts 'quantification' and 'calculation' have also been enacted in practice through the use of the M-CAI.

Effective performativity was traced in CS1 and CS2, however, it was not traced in CS3. Based on the evidence laid out under the evaluation propositions it can be argued that implementation of the M-CAI in CS1 and CS2 has altered the innovation process leading it to more transparency, understanding and better communication. However, the M-CAI did not impact the innovation process of CS3. Arguably, the nature of this public organisation requires a more rigid innovation process and their activities adhere to strict legislative guidelines. As a result the implementation of the M-CAI into the more flexible innovation process of the private organisation is more suitable.

The percentage of references to RCT performativity from all three cases as a result of the M-CAI is illustrated in Figure 6.7. CS1 makes up 64% of the references, CS2 19% and CS3 the remaining 17%.

Figure 6.7 RCT Performativity traced as a result of M-CAI
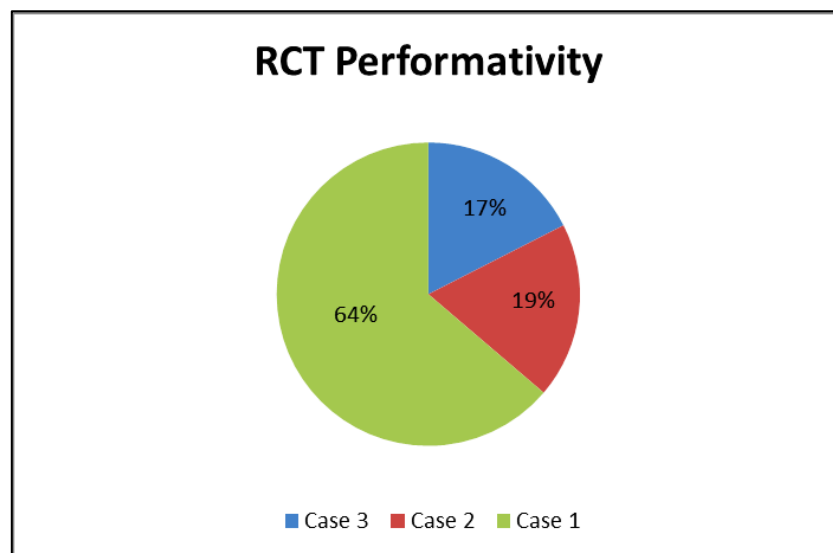
This illustrates, the M-CAI has resulted in rational decisions being constructed and enacted, ('generic performativity'), in all three cases. The core concepts 'contextualisation', 'quantification' and 'calculation' were mobilised in practice through the use of the M-CAI.

Therefore the use of the M-CAI in the innovation process in future organisations should expect similar outcomes. Furthermore, the findings have shown that the core concepts have made a difference to the innovation process, (effective performative), in CS1 and CS2. However, there was no evidence traced that would suggest effective performativity was traced in CS3. Therefore, organisations that have similar profiles to CS1 and CS2 should expect similar outcomes. However, this cannot be suggested for organisations that share similar profiles to CS3.

6.2.2 User Experience

The interpretation of the data under UX was guided largely by the work of Peter Morville's and his UX honeycomb (2004). A positive user reaction to the M-CAI was traced in all three cases, Figure 6.8. This theme was broken down further to Ease of Use and Value.

Ease of use: The M-CAI's ease of use was demonstrated in all three cases (Appendix J: P4 L57; Appendix K: P9, L58; Appendix L: P10 L23). Scroll bars were used when answering the questions and a 3D-Graph with the adoption information was provided. The scroll bars allowed the participants to directly manipulate the data while the 3D-Graph visually represented the data making it easy to understand. The participants agreed using the M-CAI required some trial and error to learn which categories to allocate their scores to and how to allocate them (Appendix L: P11, L22). However, after a few attempts this became clear (Appendix J: P4, L57; Appendix K: P9, L58; Appendix L: P10, L23). Arguably, continued use of the M-CAI will result in it becoming easier to use (Appendix L: P11, L22).

Value: All three cases agreed the M-CAI was valuable as it ensured that foundational questions were asked in the early stage, preventing later problems. CS2 participants revealed they had previously worked on projects that were hindered by poor concept definition. For example, they had to redesign one of their services due to user difficulty. They agreed this would have been avoided if they had considered the questions provided in the M-CAI at the earlier conceptual stages (Appendix K: P9, L59, 61, 62; P7, 60). Evidently, using the M-CAI to thoroughly define the concept and specify all factors can prevent issues in the testing stages. Additionally, using the M-CAI resulted in each team member being more informed and up-to date, thereby reducing informal discussions (Appendix J: P1, L62). Consequently, the M-CAI is valuable in making the process more time and cost effective.

The M-CAI was also described as useful. CS1 and CS2 participants suggested that the M-CAI helped them decide what mobile service factors and context of use factors best describe their concept. Participants also suggested that the M-CAI structured their way of thinking

(Appendix K: P7, L19). Evidently, the M-CAI is useful in assisting with the selection of alternative characteristics to define the mobile service and its context of use.

CS3 also agreed that the M-CAI was useful for concept definition and evaluation as all questions were relevant to their concept (Appendix L: P10, L26). However, due to the rigid nature of their innovation procedure they felt the M-CAI was not needed in their process as they cannot adjust or change a concept shaped by legislation (Appendix L: P10, L30, L31). However, they agreed that it would be useful, if an external contractor had to be employed as the M-CAI would guide new members through the innovation activities.

The percentage references to user experience with the M-CAI are illustrated in Figure 6.8 with CS1 making up 31% of the references, CS2 30% and CS3 the remaining 39%.

Figure 6.8 User Experience traced as a result of M-CAI
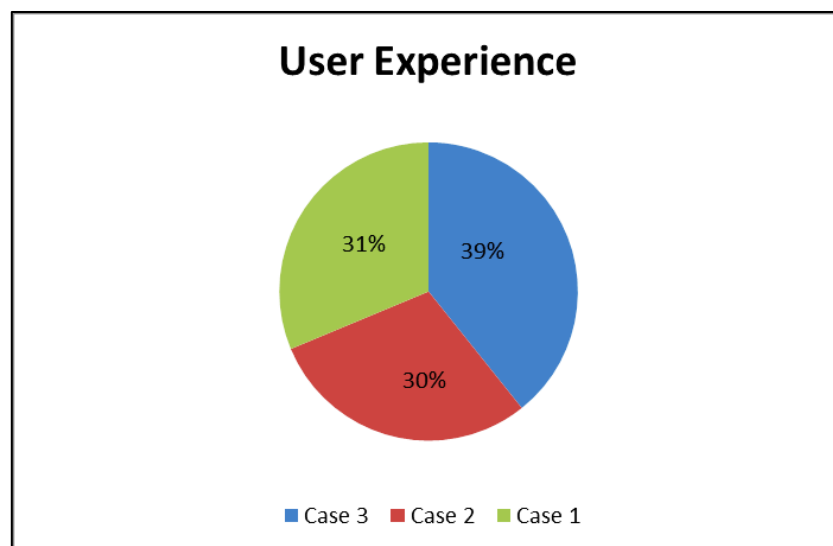
This illustrates that all three cases had a positive experience with the M-CAI regardless of whether it was applicable or not to their innovation process. Future organisational actors using the M-CAI should expect similar outcomes.

6.3 Cross Case Conclusions

This section discusses the main cross-case findings and conclusions and outlines the managerial implications of these findings. Figure 6.9 illustrates the themes traced across all three cases as a result of M-CAI. Figure 6.10 illustrates the themes traced across all three cases as a result of existing practices. From these figures it is clear that outcomes from CS1 and CS2 are almost identical and outcomes from CS3 are for the most part contradictory.

All major themes and most subordinate themes referenced in CS1 have also been referenced by CS2, Figure 6.9. As these two cases support the same outcomes replication can be claimed and organisations that fit the profile of CS1 and CS2 can expect similar outcomes.

CS1 and CS2's innovation activities prior to the implementation were informal with most of their innovative activities conducted on an ad hoc basis, even though they had some formal activities such as formal client meetings. Their overall processes are described as semi-structured. Based on the evidence outlined the M-CAI facilitates 'semi-structured innovation processes, by adding structure to the process making the activities and roles more transparent.

Figure 6.9 Themes traced across all three cases as a result of the M-CAI
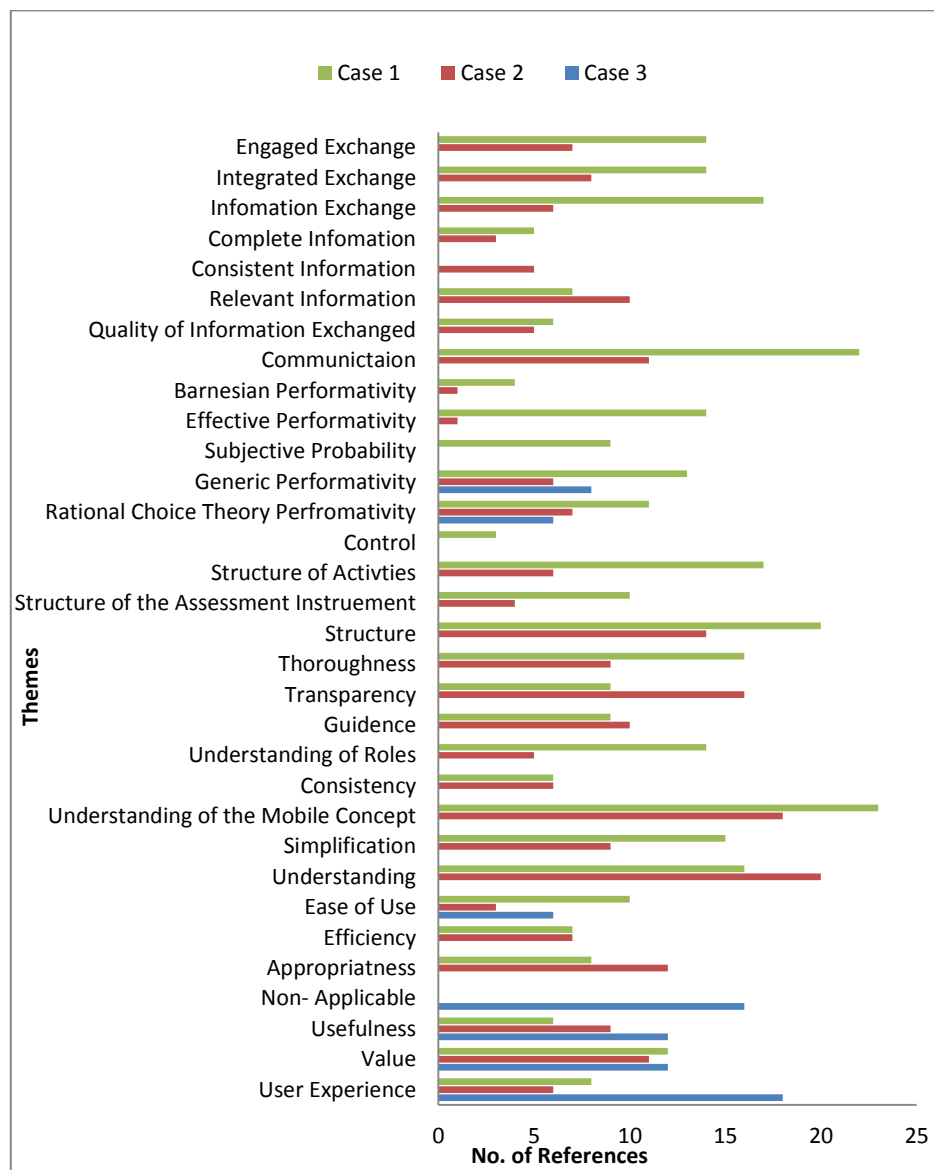
The findings also show that the M-CAI simplifies the innovation activities, improves participant understanding of the decision situation and facilitates the effective exchange of good quality information. There is no evidence to suggest the M-CAI altered the innovation process in CS3, but rather indicates that the themes traced were due to CS3s existing practices

Figure 6.10 Themes traced across all three cases as a result of Existing Practices
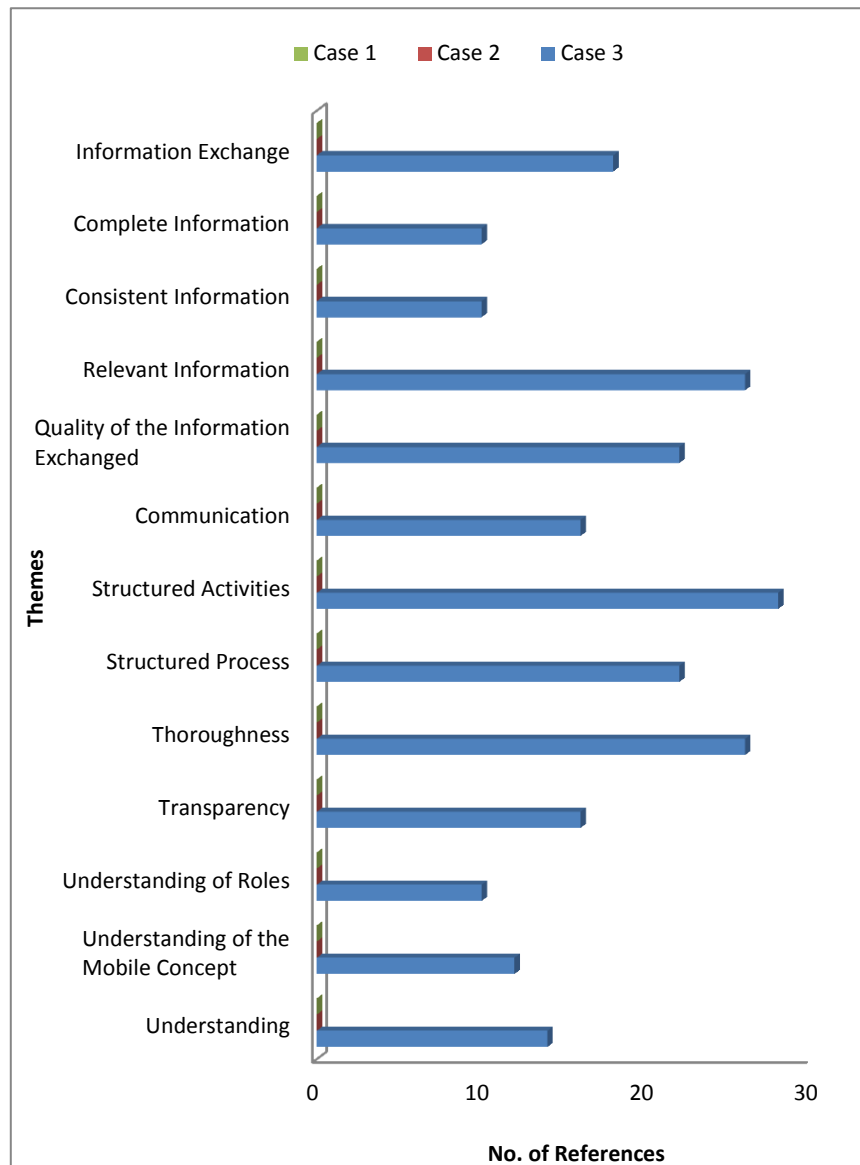
Figure 6.10 includes the themes traced in the data as a result of existing practice. Evidently, 'Transparency', 'Communication', 'Understanding' and their subordinate themes traced in CS3 were as a result of existing practices and not as the result of the M-CAI. CS3 had a 'structured' innovation process in place in comparison to the 'semi-structured' processes in both CS1 and CS2. Consequently, the M-CAI had less of an impact on CS3. Hence, the M-CAI may not be applicable for organisations with structured innovation processes.

Therefore, one can argue the implementation of the M-CAI structures the more flexible process of the private organisations while also allowing them the creative space necessary to develop their mobile concepts.

6.4 Implications of the Findings

This section discusses the implications of the cross case findings for innovation managers. This information can be used by innovation managers to improve their front end processes and therefore contribute to the overall success of new mobile services.

Both CS1 and CS2 share the following characteristics: small private organisations, less than fifty employees, with a 'semi-structured' innovation processes. While there is no evidence to suggest that the 'organisational size', 'the number of employees' or 'actor diversity' have any impact on the findings, evidence has been traced in the data which suggests that the organisations 'innovation process activities' can impact the outcomes of the process. In addition the 'innovation process activities' can impact the applicability of the M-CAI as it will have more of an impact on the outcomes of an informal or semi-structured process, than a structured process.

- Evidently, the 'Innovation Process Activities' will impact the outcomes of the innovation process. Thus confirming the suggestions of existing literatures (Postma et al. 2012; Sætre 2012; Poskela and Martinsuo 2009; Cooper 2011; Ho et al. 2011; Verworn et al. 2008).

Therefore, it is important for innovation managers to effectively control the FEI activities in order to mitigate the effects that an informal or unstructured process may have as this will impact the overall success of the new service. This study argues that the proposed M-CAI can assist with this. The M-CAI is more applicable to organisations with semi-structured or informal processes such as those in CS1 and CS2. In contrast, the M-CAI will have less impact on structured processes such as that in CS3.

- It can be concluded that the M-CAI is more applicable for organisations with 'semi-structured' or 'informal' innovation processes.

The strict legislative guidelines adhered to by CS3, (public sector organisation), resulted in the M-CAI being deemed less applicable for their organisation. In contrast CS1 and CS2 are private organisations. Therefore the services being created in these cases were of a

commercial nature. As competition from other organisations is guaranteed, more creativity on the part of the private organisations is expected. Consequently, commercial services have more flexibility, and room to adapt the service concept, in contrast to public services which are more restricted.

- Consequently, the next conclusion drawn from the findings is that the 'Organisational Sector', (e.g. public vs private sector), will also impact the applicability of the M-CAI. Specifically, the M-CAI is less applicable for public organisations, whose services are restricted by legislation, in comparison to private organisations with more flexible services.

In addition, as the mobile concept created by CS3 will facilitate a public service, it is the only service available for the public to achieve their goal and the service is not in competition with any others. Consequently, it is expected to have high adoption. As a result, investment into the M-CAI would not be as applicable for their process.

- The M-CAI may not be applicable to innovation processes, where adoption is not a key decision element. For example, services which are not in competition with others.

The findings discussed in the last section, illustrate the construction and enactment of rational decisions through the use of the M-CAI. Specifically, the core concepts of crafting rational decisions, 'contextualisation', 'quantification and 'calculation', have been mobilised in practice in all three case studies, (e.g. generic performativity). Furthermore, evidence of 'effective performativity' in the first two cases, illustrates how the M-CAI has 'made a difference' to the innovation process. As a result, the M-CAI has facilitated and consequently improved decision making at the front end of mobile service application innovation. Therefore, managers can apply the core concepts to other innovation practices to improve front end decision making accordingly.

Finally, a positive user reaction with the M-CAI has been traced in all three cases, Figure 6.9. The findings described the M-CAI as 'easy to use', 'valuable' and 'useful'. The M-CAI ensures the concept is defined extensively prior to the design and development stages where it may be more costly to make changes. This supports the business challenge of defining and evaluating the mobile concept in the innovation stages. Furthermore, the findings suggest the M-CAI would be useful in the cases where others, (outside the team), may be involved in the innovation process as they may not be familiar with ongoing activities and the M-CAI could

guide them. Based on this one can argue the M-CAI would be useful for companies with structured processes when an external contractor is employed.

- Regardless of organisational characteristics, (e.g. sector, size, innovation activities, etc.) the M-CAI has a positive impact on user experience. Therefore, future innovation managers and organisational actors who use the M-CAI should also expect similar outcomes.

The findings have shown that the M-CAI was applicable for CS1 and CS2 as it fitted in well with their current process. The information generated when evaluating the mobile concept was appropriate as the M-CAI highlighted the areas which needed further attention. Undoubtedly, the M-CAI was applicable to CS1 and CS2 as it impacted the outcome of their innovation process. Consequently, the M-CAI would be most applicable to organisations with similar profiles to CS1 and CS2.

6.5 Chapter Summary

This chapter summarised the findings and interpretations of the cross case analysis under the evaluation propositions. The additional themes to emerge, (UX and RCT Performativity), were also discussed. Following this the main conclusions were drawn and the implications of the findings for innovation managers were discussed.

Chapter 7: Thesis Summary and Conclusions

7.1 Overview

The core objective of this research was to improve the front end of mobile service innovation by facilitating decision makers to better define and evaluate mobile concepts. This was achieved by designing and developing a Mobile Concept Assessment Instrument, (M-CAI) and by implementing it in the innovation process of three real-world organisations, (case studies). This chapter revisits the research questions and summarises the main outcomes. The research contributions are highlighted along with the implications for both theory and practice. The chapter concludes by summarising the threats to the validity of the research findings and the precautions taken to ensure that the findings are both valid and reliable. Finally, limitations of the research are outlined together with recommendations for future research.

7.2 Revisiting the Research Questions

The overarching research question presented was:

"How Can The Front End of Mobile Service Innovation Be Improved?"

To address this, three additional research questions RQ1, RQ2, and RQ3 were developed. The first research question aimed to understand the specific challenges at the front end of mobile service innovation and why they were occurring:

RQ1: What are the challenges at the front end of mobile service innovation?

These challenges were outlined in chapter three, (section 3.1.3 and 3.2.2). It was found that:

1) The majority of literatures addressing front end activities focused on 'idea generation and selection' activities and neglected all other activities. In particular, there was a lack of research to support the concept development, (concept definition and evaluation), activities. This point was agreed upon by experts in the IT services sector. Therefore, this challenge exists not only in theory, but also in practice.

2) The front end lacks structure and control and as a result decisions are made on an ad hoc basis where key information is often ignored and hence can lead to the selection of inferior alternatives.

3) Effective exchange of information is difficult to achieve as information regarding service innovation is tacit, barely formalised, scarcely supported by relevant tools and therefore

impacts on the decision makers understanding of key decision information and consequently decision making at the front end.

4) The ineffective running of these activities leads to difficulties such as managers becoming committed to failing projects as they are less likely to terminate projects after the 'go' decision has been made.

In view of these existing challenges RQ1 is deemed to have been answered. In order to determine how to address these challenges the second research question (RQ2) asked:

RQ2: How can the challenges at the front end of mobile service innovation be addressed?

Key requirements needed to address the front end issues were gathered from experts in the IT services sector together with the requirements needed for a practical solution, chapter three, (section 3.3).

- The experts implied adding structure to the front end activities would address the lack of formality at the front end.
- To address the issue of the ineffective exchange of key information the experts suggested structuring the way information is exchanged at the front end.
- To improve the understanding of key decision elements the requirement specified was to simplify the concept definition and evaluation activities.
- To ensure the research solution was practical experts advised that it provide a good user experience.

The literature was examined in chapter three, (section 3.4), to find suitable theories and principles to help meet the requirements. By applying these theories and principles the M-CAI was created.

Based on the above outlined information RQ2 is deemed to have been answered.

Finally to determine if the challenges were addressed and to discover what changes may have occurred as a result of the M-CAI's implementation and use at the front end of the mobile service innovation, the third research question asked:

RQ3: How has the front end of mobile service innovation been altered, (changed/improved/unaffected), as a result of the research solution?

The most common changes to the process for mobile service innovation were:

1) Changes to the exchange of key information at the front end resulted in improved communication in the process. The findings suggest that the exchange of information was more integrated using the M-CAI and participants were more engaged when exchanging information. This therefore addresses the issue of ineffective exchange of key information at the front end.

2) Changes to the structure of the activities in the process resulted in activities and roles becoming more transparent. The research findings suggest the activities in the innovation process were clear and conducted in a much more thorough manner when using the M-CAI. The activities were described as well-structured and easier to manage and control. Therefore the issue of a lack of formality at the front end has been addressed.

3) Process simplification resulted in improvements to the decision makers understanding of key decision elements. The findings suggest that the M-CAI simplified the act of defining and evaluating mobile concepts and aided the understanding of the key decision elements.

4) Organisational sector impacted the applicability of the M-CAI and was shown to be suitable for private organisations, however, it was deemed less applicable for public organisations restricted by legislation.

5) The M-CAI was found to be suitable for organisations with 'informal' or 'semi-structured' innovation processes and was less suitable in organisations with rigid or highly structured innovation processes.

Based on the above, RQ3 is deemed to have been answered.

7.3 Research Contributions

This research has made contributions in a number of important respects. The contributions represent a significant addition to IS research, particularly to the Innovation Management and Mobile Service bodies of knowledge. This section discusses these contributions under primary and secondary contributions.

7.3.1 Primary Contributions

The main contribution of this research is that this is the first study to create an interactive assessment instrument, (M-CAI), to help solve existing challenges at the front end of mobile service innovation and to demonstrate improvements to the process based on its implementation and use. The M-CAI assists with defining and evaluating mobile concepts at

the front end of mobile service innovation. As a result, the field of innovation management is advanced by the provision of a novel tool that can be used for concept definition and evaluation activities. To date, studies addressing the front end activities mainly focused on 'idea generation and selection' while 'concept definition and evaluation' were till now, largely neglected.

The second contribution is the recognisable improvement to the front end of mobile service innovation as a result of the M-CAI. Throughout the scientific literature, the front end is characterised by its ambiguous nature and ill-defined processes. The novel instrument provided here adds transparency to this ambiguous process. Therefore, this research builds on the work of others who sought to add clarity to the front end (Koen et al. 2001; Koen et al. 2014) and has demonstrated how to further clarify the concept definition and evaluation activities at the front end of mobile service innovation. The front end is supported in the following ways:

- The exchange of information has been altered thereby improving communication among organisational actors. Typically key decision information was ignored if not exchanged effectively. Therefore, this research provides the means to positively alter the exchange of information at the front end.

- Structure is added to the front end process, thereby making the activities and roles more transparent. Typically the front end lacked structure and transparency, which results in decisions being made on an ad hoc basis and consequently the selection of inferior alternatives. This research demonstrates the means to address this challenge by adding structure at the front end.

- The key decision information specified and structured in the M-CAI simplifies the act of defining mobile concepts and improves the understanding of the key decision elements. Typically key information at the front end was tacit and barely supported by relevant tools. Therefore, this research provides the means to address this challenge.

The third contribution is the extension of the theory of crafting rational decisions in practice to the field of innovation management. The empirical findings of this study have traced 'rational choice theory, (RCT), performativity' within all three cases. Consequently, this research has extended the work of Cabantous et al. (2010) to the front end of mobile service innovation and has demonstrated its applicability to field of Innovation Management.

The fourth contribution is the improvement of decision making within the innovation process. By extending Cabantous et al.'s (2010) theory, rational decisions have been constructed and

enacted in innovation practice. This is an important contribution as decision making at the front end is often challenging. Therefore, this research provides the means to improve decision making in the process for mobile service innovation.

The fifth contribution is the inclusion of adoption information in the innovation process. This is an important addition as current research on innovation creation at the front end fails to consider adoption information. Thus, this research addresses this important issue.

7.3.2 Secondary Contributions

In addition to the primary contributions identified, a number of secondary contributions are also outlined.

The first of these is the research framework Figure 3.1. This is the first conceptual model of the front end of mobile service innovation that shed light on these practices. This provides insight for future studies at the front end of mobile service innovation.

The next contributions are the taxonomies of factors which influence the adoption of mobile services. These contributions can be used to examine the factors which influence the adoption of mobile services and can be considered when creating mobile services.

Another contribution is the prioritisation of the most important factors for inclusion in the innovation process (Table 4.6). This contribution can be considered when creating mobile services.

The final contributions are the quantified data tables presented in chapter four, (section 4.4). This is the first attempt to aggregate, categorise and quantify the adoption of mobile services in terms of mobile service and context of use characteristics. The adoption information provided by the M-CAI acts as an indication and does not claim to predict the adoption of mobile services. The data required to calculate a 'true' adoption score to predict the potential adoption of mobile services is currently non-existent/insufficient and to date has not yet been accumulated and classified. However, using the M-CAI as a 'classification tool' can over time accumulate the data necessary to predict true adoption scores. Consequently, the M-CAI has the potential to evolve into a prediction model and over time contribute further to both the innovation management and mobile service bodies of knowledge.

7.4   Implications for Practice and Research

7.4.1 Implications for Practice

There are a number of key stakeholders who can benefit from the contributions of this thesis for example, innovation managers, designers and mobile application developers.

For private sector practitioners the most significant outcomes are the benefits of using the M-CAI for the front end activities. Practitioners should consider adding structure to the front end activities which will enable more effective exchange of vital decision information. This can improve the decision makers understanding of key decision elements and consequently, their overall decisions. The M-CAI, provided by this research, has demonstrated its ability to effectively do this.

Following implementation and use of the M-CAI these outcomes should be replicated in all organisations with semi-structured or informal innovation activities within the private sector.

However, in terms of organisations within the public sector the M-CAI is deemed less applicable due to the organisation being restricted by legislation. Therefore, investment into the M-CAI may not be appropriate here.

It cannot be specified whether the M-CAI is applicable for organisations which differ in terms of 'organisational size', 'the number of employees' or 'the actor's diversity', etc. However further investigations in the broader disciplines could enlighten this.

Finally, the M-CAI has had a positive user experience in all three cases; therefore organisations whose profiles are similar to the cases in this thesis can expect a positive experience with the M-CAI.

7.4.2 Implications for Research

The contributions also have important implications for researchers in the field of innovation management.

Firstly, the thesis demonstrated the applicability of the theory of crafting rational decisions in practice for the field of innovation management in the context of mobile service innovations. Therefore, researchers in the field of innovation management can benefit by applying this theory to innovation decision making in other contexts.

Secondly characteristics such 'organisational sector' and 'process structure' can influence the applicability of research solutions for the front end of mobile service innovation. Therefore,

precautions should be taken by researchers to safeguard the suitability of future research tools and techniques.

In addition, as it is unknown if characteristics such as organisational size, 'the number of employees' or 'the actor's diversity', etc. will impact the suitability of the research solution for the front end. Researchers should consider these characteristics and investigate their impact on the applicability of future research solutions.

7.5 Revisiting the Threats to the Validity of the Findings

Chapter two, (section 2.4), outlined the tactics that would be taken throughout the research to safeguard against the threats to the validity and reliability of the research findings. These are now revisited to ensure these threats have been deterred.

7.5.1 Threats to the Validity of the Design of the M-CAI

The first threat is to the validity of the design of the M-CAI and the information it contains. To ensure that the information included in the M-CAI is valid and relevant a QCA two focus groups and an AHP technique was conducted.

The QCA included multiple sources of data from various well rated journals and online databases as well as computing surveys. This therefore reduced the risk of omitting key factors from the M-CAI.

From this QCA two taxonomies of factors were created. These were refined using a focus group to ensure that the factors were relevant from a practitioner perspective. A threat was that dominant characters may take over the discussion and skew the refinement of the taxonomies. To prevent this, the focus group was conducted following the KJ method (Spool 2004). This ensured the participants had equal input into the refinement and prevented dominant participants influencing the results.

To prioritise and select factors for inclusion, the AHP technique was applied by the wider community of 20 participants. This helped to strengthen the validity of the design as the factors were selected from multiple perspectives.

The designed M-CAI was demonstrated to industry experts in a voluntary open sourced organisation for feedback. This strengthened the validity as the design was refined based on multiple experts' suggestions.

7.5.2 Threats to the Validity of the Evaluation of the M-CAI

The next threats revisited are in relation to the validity of the evaluation findings.

This research first outlined what is meant by a 'change/alteration' to the front end of mobile service innovation, by defining evaluation propositions. These propositions scoped the investigation and were inspected following the rigorous thematic analysis approach proposed by Fereday and Muir-Cochrane (2008).

To ensure the evaluation findings were valid the data was triangulated. Multiple sources of evidence were gathered through the means of interviews, field notes and documentation data, (from multiple participants across three case studies), in a manner encouraging convergent lines of inquiry. When three or more sources referenced a particular theme it was deemed to be valid.

To add credibility to the research findings, this thesis ensured that the findings are transparent. For example, quotes from the transcripts were cited during the data analysis and interpretation to maintain a chain of evidence.

To determine whether the findings were 'generalisable' beyond the immediate cases included in this thesis replication logic was followed. When two or more cases have similar outcomes, replication can be claimed (Yin 2013). In this study the findings from CS1 were replicated in CS2. This therefore strengthens the validity of the findings.

7.5.3 Reliability of the Study

A number of steps were also taken to ensure the research is reliable.

- A case study protocol was created to outline the case study procedures and ensure transparency.
- The 'raw' data captured in this study is made as accessible as practically possible to the reader.
- A formal database of the case study data was created so external observers can inspect, question and re-interpret the data, if necessary.

7.6 Research Limitations

Thirteen factors were selected for inclusion in the M-CAI as it was impractical to include all possible factors. Therefore, the M-CAI and the change it can make to the front end are limited

in this regard. To consider a more comprehensive list of factors at the front end one can examine the taxonomies provided by this research (Appendix D and E).

While the factors included in the M-CAI are limited, considerable care was taken to ensure the most important factors were prioritised and selected for inclusion. While care was taken, the prioritised factors can never be guaranteed to reflect the opinions of the entire community, as the opinions of experts may differ.

Another limitation is that it cannot be guaranteed that the taxonomies of influencing factors are complete. Therefore, there is a possibility that some factors could have been overlooked. However, to ensure the taxonomies were as complete as possible a comprehensive QCA with over 200 literature contributions was conducted before being reviewed and refined by industry experts.

Assessing mobile concepts involves the consideration of a number of criteria. The M-CAI has provided fundamental information, (e.g. adoption information), for this process in a controlled manor. To carry out a wider ranging assessment one can combine the information provided by the M-CAI with additional information, such as technology capabilities, customer perceptions, market factors, costs, resources, etc. when making assessments. To include all possible criteria in the M-CAI would be impractical and would fall outside the scope of a doctorial study. However, it is common in practice for organisations to combine a series of tools throughout their decision making activities (Cabantous et al. 2010).

In terms of evaluating the impact of the M-CAI considerable care was taken collecting data from the case study organisations. A possible limitation is the subjectivity of the individual participant's responses to the semi-structured interviews. To minimise the impact of this limitation multiple sources of data were gathered and 'triangulated' to check if the different sources converged towards the same outcomes. However, even these steps cannot completely eliminate the risk of subjective interpretation. To strengthen the credibility of the findings the researcher combined the interpretative investigation with positivist validation techniques. For instance, replication logic was followed and the case findings inspected for 'replication'.

The research is also limited in terms of the number of participating case study organisations due to the limited time and resources available for the doctorial study. As a result, it cannot be specified whether or not the M-CAI is applicable to organisations with varying characteristics such as organisational size, the number of employees or the actor's diversity, etc. The M-CAI needs to be evaluated with more case investigations in broader disciplines to understand its

applicability further. Although, the evaluation included a limited number of cases, all cases conducted were in depth, transparent and captured rich information which provided credibility to the investigation.

7.7 Future Research

Important future work will involve revisiting and further refining the M-CAI. The M-CAI operates in Microsoft Excel. Future work could involve development as a web based tool to provide added convenience for its users. Over time the applicability of the factors included in the M-CAI may change, therefore, future studies that further examine and add to or adjust these factors could be beneficial in the innovation process. Currently, the adoption information provided by the M-CAI, (e.g. the 3D-Graph), solely acts as an indication and does not claim to predict the adoption of mobile services. Future work could use the M-CAI as a 'classification tool' to classify mobile adoption data over time. By doing this, more accurate adoption scores can be calculated.

Future research would also benefit from more studies into the prioritisation of adoption factors for inclusion in the innovation process. Further studies that weigh and rank adoption factors in terms of their importance could strengthen or adjust the factors prioritised by this study and provide further valuable insight when creating mobile service innovations.

More case study investigations would be beneficial to understand if the additional organisational characteristics, (e.g. organisational size, the number of employees, organisational actors, etc.), have an impact on the applicability of the M-CAI and consequently its impact of the front end. This would also mean the outcomes of the cases could be replicated in cases with varying characteristics and consequently the generalisation of the findings could be extended.

The case study findings could also be interpreted from additional perspectives. Specifically, the coding of the data could involve several individuals with themes being developed using discussions with other researchers and or a panel of experts.
Finally, future research should concentrate on further improving the front end of innovation, particularly, in the context of mobile service innovations. This thesis has stressed the lack of research on the FEI and how it is barely studied in connection with mobile services. Therefore, more empirical studies, which focus on the activities at the front end of mobile service innovation, are required. This research has demonstrated the applicability of Cabantous et al.'s (2010) theory for the front end of mobile service innovation. Future research could apply this

theory to facilitate decision making at the front end of other innovation contexts. Finally, this thesis highlighted that most studies addressing the front end activities mainly focus on 'idea generation and selection' and as a result the remaining activities are neglected. Due to this gap in the literature and the industry relevance, this thesis has focused on facilitating concept definition and evaluation activities. Therefore, future studies could expand on to opportunity identification and evaluation activities at the FEI and particularly at the front end of mobile service innovation.

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Appendices

Appendix A: Selected Journal Papers (2005-2014)

Rank/Source	Journal	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
AIS Basket of Eight	EJIS	[2]	[1; 3-9]	[10-11]	[12-13]	[14]	[15]	[16]	[17-18]	[19-20]	[21-24]	24
	ISJ	-	-	-	-	-	-	-	-	-	-	0
	ISR	[25]	[26]	-	-	-	-	-	[27]	[28-29]	-	5
	JAIS	[30]	-	-	[31]	[32]	[33]	-	-	-	[34]	5
	JIT	-	[35]	-	[36]	[37-39]	-	-	-	[40]	[41]	7
	JMIS	[42-44]	[45-46]	[47]	[48]	-	[49]	[50-51]	[52]	[53]	-	12
	JSIS	[54-56]	-	[57-59]	[60]	[61]	-	-	-	[62]	-	9
	MISQ	[63-65]	[66-68]	[69]	[70-71]	[72-74]	[75-76]	[77]	-	[78-80]	[81]	19
												Total 81
MIS Journal Rating:	CACM	[82-83]	[84]	[85-86]	-	[87-88]	-	-	-	-	-	7
	MS	-	-	-	-	-	[89]	[90]	-	-	-	2
	AI	-	-	-	-	-	-	-	[91-92]	-	-	2
	DSJ	-	-	[93]	[94-95]	[96]	[97]	-	-	-	[98-99]	7
	HBR	-	-	-	-	-	-	-	-	-	-	0
	IEEE Tr.	-	[100]	-	[101]	[102]	-	-	[103-104]	[105]	-	6
	AIMag	-	-	-	-	-	[106]	-	-	-	-	1
	DSS	[107]	[108]	-	-	-	-	[109]	[110-112]	[113-114]	-	7
	I&M	[115]	[116-117]	[118]	[119]	[120]	-	-	[121]	[122]	-	8
	JCSS	-	-	-	-	-	-	-	-	-	-	0
	SMR	-	-	-	-	-	-	-	-	-	-	0
	CAIS	-	-	[123]	[124]	[125]	-	[126]	-	-	[127]	5
												Total 46
National Journal Ratings Consolidated TIER	B&IT	-	-	[128]	[129-130]	-	-	[131-132]	-	[133]	[134]	7
	BR&I											0
	ECR	-	-	-	-	[135]	-	[136]	-	-	-	2
	HCI	-	-	-	-	-	-	-	-	-	[137]	1
Total	**31**											10
												137

Appendix B: Numerical Index of Sources Included in QCA

AIS Basket of Eight

Rank - Source	Journal	Year	Title	Author	Cite
AIS Basket of Eight	EJIS	2006	Exploring the influence of reference situations and reference pricing on mobile service user behaviour	Jennifer Blechar , Ioanna D Constantiou & Jan Damsgaard	1
	EJIS	2005	Investigating enterprise systems adoption: uncertainty avoidance, intrinsic motivation, and the technology acceptance model	Yujong Hwang	2
	EJIS	2006	Contextual influences on user satisfaction with mobile computing: findings from two healthcare organizations	Rens Scheepers , Helana Scheepers & Ojelanki K Ngwenyama	3
	EJIS	2006	Mobile computing: a user study on hedonic|[sol]|utilitarian mobile device usage	Robin L Wakefield & Dwayne Whitten	4
	EJIS	2006	Introduction to the special issue on mobile user behaviour	Hans van der Heijden and Iris Junglas	5
	EJIS	2006	Switching behavior of mobile users: do users' relational investments and demographics matter?	C Ranganathan , DongBack Seo & Yair Babad	6
	EJIS	2006	Secondary user relations in emerging mobile computing environments	Elaine Ferneley & Ben Light	7
	EJIS	2006	Enacting new temporal boundaries: the role of mobile phones	Elpida Prasopoulou , Athanasia Pouloudi & Niki Panteli	8
	EJIS	2006	An empirical study on Web-based services and customer loyalty	Samuel Otim & Varun Grover	9
	EJIS	2007	An investigation into the factors influencing the adoption of B2B trading exchanges in small businesses	Mohammed Quaddus and Glenn Hofmeyer	10
	EJIS	2007	Perceived network externalities and communication technology acceptance	Troy J Strader , Sridhar N Ramaswami & Philip A Houle	11
	EJIS	2008	The moderating role of customer–technology contact on attitude towards technology-based services	Aristeidis Theotokis, Pavlos A Vlachos and Katerina Pramatari	12
	EJIS	2008	Personality traits and concern for privacy: an empirical study in the context of location-based services	Iris A Junglas, Norman A Johnson and Christiane Spitzmüller	13
	EJIS	2009	Consumer acceptance of RFID-enabled services: a model of multiple attitudes, perceived system characteristics and	Katerina Pramatari and Aristeidis Theotokis	14

			individual traits		
	EJIS	2010	The digital divide and t-government in the United States: using the technology acceptance model to understand usage	Janice C Sipior, Burke T Ward and Regina Connolly	15
	EJIS	2011	Enriching our theoretical repertoire: the role of evolutionary psychology in technology acceptance	Chon Abraham, Marie-Claude Boudreau, Iris Junglas and Richard Watson	16
	EJIS	2012	Towards integrating acceptance and resistance research: evidence from a telecare case study	Marjolein van Offenbeek, Albert Boonstra and DongBack Seo	17
	EJIS	2012	Understanding online customers' ties to merchants: the moderating influence of trust on the relationship between switching costs and e-loyalty	Michelle Carter, Ryan Wright, Jason Bennett Thatcher and Richard Klein	18
	EJIS	2013	Internet adoption by the elderly: employing IS technology acceptance theories for understanding the age-related digital divide	Björn Niehaves and Ralf Plattfaut,	19
	EJIS	2013	Cultural and generational influences on privacy concerns: a qualitative study in seven European countries	Caroline Lancelot Miltgen[1] and Dominique Peyrat-Guillard[1]	20
	EJIS	2014	Changing information retrieval behaviours: an empirical investigation of users' cognitive processes in the choice of location-based services	Ioanna D Constantiou, Christiane Lehrer and Thomas Hess	21
	EJIS	2014	Examining the antecedents of user gratification and its effects on individuals' social network services usage: the moderating role of habit	Chao-Min Chiu and Hsin-Yi Huang	22
	EJIS	2014	An organizational perspective on m-business: usage factors and value determination	Winnie Ng Picoto, France Bélanger and António Palma-dos-Reis	23
	EJIS	2014	Five-factor model personality traits as predictors of perceived and actual usage of technology	Tim Barnett , Allison W. Pearson , Rodney Pearson and Franz W. Kellermanns	24
	ISJ	-	-	-	-
	ISR	2005	Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry	Kevin Zhu, Kenneth L. Kraemer	25
	ISR	2006	Understanding the Adoption of Multipurpose Information Appliances: The Case of Mobile Data Services	Se-Joon Hong, Kar Yan Tam,	26
	ISR	2012	Research Note—Effects of Individual Self-Protection, Industry Self-Regulation, and Government Regulation on Privacy Concerns: A Study of Location-Based Services	Heng Xu, Hock-Hai Teo, Bernard C. Y. Tan, Ritu Agarwal	27
	ISR	2013	Predicting Adoption Probabilities in Social Networks	Xiao Fang, Paul Jen-Hwa Hu, Zhepeng (Lionel) Li, Weiyu Tsai	28
	ISR	2013	Motivational Differences Across Post-Acceptance	Xixi Li, J. J. Po-An Hsieh, Arun Rai	29

			Information System Usage Behaviors: An Investigation in the Business Intelligence Systems Context		
	JAIS	2005	Is There a Global Digital Divide for Digital Wireless Phone Technologies?	Angsana A. Techatassanasoontorn, Robert J. Kauffman	30
	JAIS	2008	An Experimental Study on Ubiquitous commerce Adoption: Impact of Personalization and Privacy Concerns	Hong Sheng, Fiona Fui-Hoon Nah, Keng Siau	31
	JAIS	2009	Understanding Post-adoption Usage of Mobile Data Services: The Role of Supplier-side Variables	Sanghoon Lee, Bongsik Shin, Ho Geun Lee	32
	JAIS	2010	Modeling Citizen Satisfaction with Mandatory Adoption of an E-Government Technology	Frank K.Y. Chan, James Y.L. Thong, Viswanath Venkatesh, Susan A. Brown, Paul Jen-Hwa Hu et al.	33
	JAIS	2014	The Role of Signaling Identity in the Adoption of Personal Technologies	Alessandro Arbore, Isabella Soscia, Richard P. Bagozzi	34
	JIT	2006	An empirical investigation into the utilization-based information technology success model: integrating task-performance and social influence perspective	Changki Kim , Jungjoo Jahng & Jinjoo Lee	35
	JIT	2008	Linking IT implementation and acceptance via the construct of psychological ownership of information technology	Henri Barki, Guy Paré and Claude Sicotte	36
	JIT	2009	What drives the adoption of mobile data services? An approach from a value perspective	Byoungsoo Kim and Ingoo Han	37
	JIT	2009	Who influences whom? Analyzing workplace referents' social influence on IT adoption and non-adoption	Andreas Eckhardt, Sven Laumer and Tim Weitzel	38
	JIT	2009	The role of (personal) network effects and switching costs in determining mobile users' choice	Juan Pablo Maicas, Yolanda Polo and Francisco Javier Sese	39
	JIT	2013	Can customer satisfaction and dissatisfaction coexist? An issue of telecommunication service in China	Aihui Chen, Yaobin Lu, Sumeet Gupta and Qi Xiaolin	40
	JIT	2014	Toward a process-based view of information technology acceptance	Andrew Schwarz, Wynne W Chin, Rudy Hirschheim and Colleen Schwarz	41
	JMIS	2005	The Effects of Information Format and Shopping Task on Consumers' Online Shopping Behavior: A Cognitive Fit Perspective	Hong, Weiyin , Thong, James Y.L. and Tam, Kar Yan	42
	JMIS	2005	A Multidimensional Commitment Model of Volitional Systems Adoption and Usage Behavior	Malhotra, Yogesh and Galletta, Dennis F.	43
	JMIS	2005	Does Information Technology Training Really Matter? A Social Information Processing Analysis of Coworkers' Influence on IT Usage in the Workplace	Gallivan, Michael J. , Spitler, Valerie K. and Koufaris, Marios	44
	JMIS	2006	Moderating Effects of Task Type on Wireless Technology Acceptance	Fang, Xiaowen , Chan, Susy , Brzezinski, Jacek and Xu, Shuang	45
	JMIS	2006	Evaluating the Adoption of Enterprise Application Integration in Health-Care Organizations	Khoumbati, Khalil , Themistocleous, Marinos and Irani, Zahir	46
	JMIS	2007	Attention Issues in Spatial Information Systems: Directing Mobile Users' Visual Attention	Biocca, Frank , Owen, Charles , Tang, Arthur and	47

			Using Augmented Reality	Bohil, Corey	
	JMIS	2008	In Justice We Trust: Predicting User Acceptance of E-Customer Services	Turel, Ofir , Yuan, Yufei , Connelly, Catherine E.	48
	JMIS	2010	Predicting Collaboration Technology Use: Integrating Technology Adoption and Collaboration Research	Brown, Susan A. , Dennis, Alan R. and Venkatesh, Viswanath	49
	JMIS	2011	Impact of Technostress on End-User Satisfaction and Performance	Tarafdar, Monideepa , Tu, Qiang and Ragu-Nathan, T. S.	50
	JMIS	2011	Consumer Acceptance of Recommendations by Interactive Decision Aids: The Joint Role of Temporal Distance and Concrete Versus Abstract Communications	Köhler, Clemens F. , Breugelmans, Els and Dellaert, Benedict G.C.	51
	JMIS	2012	The Influence of Individual, Contextual, and Social Factors on Perceived Behavioral Control of Information Technology: A Field Theory Approach	Elie-dit-cosaque, Christophe , Pallud, Jessie and Kalika, Michel	52
	JMIS	2013	Understanding Postadoptive Behaviors in Information Systems Use: A Longitudinal Analysis of System Use Problems in the Business Intelligence Context	Deng, Xuefei (Nancy) and Chi, Lei	53
	JSIS	2005	Special Issue Part II: understanding the contextual influences on enterprise system design, implementation, use and evaluation	Erica Wagner, Debra Howcroft, Sue Newell	54
	JSIS	2005	Mandates and technology acceptance: A tale of two enterprise technologies	Bongsug Chae, Marshall Scott Poole	55
	JSIS	2005	Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology	June Lua,, James E. Yaob , Chun-Sheng Yua	56
	JSIS	2007	Understanding user behavior with new mobile applications	Raquel Benbunan-Ficha, Alberto Benbunan,	57
	JSIS	2007	Exploring consumer adoption of mobile payments – A qualitative study	Niina Mallat	58
	JSIS	2007	The adoption of consortium B2B e-marketplaces: An exploratory study	Andrew White, Elizabeth Daniel, John Ward, Hugh Wilson	59
	JSIS	2008	Trust and risk in e-government adoption	France Bélanger, Lemuria Carter	60
	JSIS	2009	The moderating effect of the business strategic orientation on eCommerce adoption: Evidence from UK family run SMEs	Yong Wang, Pervaiz K. Ahmed	61
	JSIS	2013	Mobility at work: A typology of mobile communities of practice and contextual ambidexterity	Jan Kietzmann, Kirk Plangger, Ben Eaton, Kerstin Heilgenberg, Leyland Pitt, Pierre Berthon	62
	MISQ	2005	Moving Beyond Intentions and Toward the Theory of Trying: Effects of Work Environment and Gender on Post-Adoption Information Technology Use	Manju K. Ahuja and Jason Bennett Thatcher	63
	MISQ	2005	Understanding User Responses to Information Technology: A Coping Model of User Adaption	Anne Beaudry and Alain Pinsonneault	64
	MISQ	2005	A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems	Jon (Sean) Jasperson, Pamela E. Carter, and Robert W. Zmud	65
	MISQ	2006	Understanding and Predicting Electronic Commerce Adoption: An Extension of the	Paul A. Pavlou and Mendel Fygenson	66

	Journal	Year	Title	Author	Cite
			Theory of Planned Behavior		
	MISQ	2006	The Role of Espoused National Cultural Values in Technology Acceptance	Mark Srite and Elena Karahanna	67
	MISQ	2006	Influence Processes for Information Technology Acceptance: An Elaboration Likelihood Model	Anol Bhattacherjee and Clive Sanford	68
	MISQ	2007	Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective	Andrew Burton-Jones and Michael J. Gallivan	69
	MISQ	2008	Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation	Viswanath Venkatesh, Susan A. Brown, Likoebe M. Maruping, and Hillol Bala	70
	MISQ	2008	A Fast Form Approach to Measuring Technology Acceptance and Other Constructs	Wynne W. Chin, Norman Johnson, and Andrew Schwarz	71
	MISQ	2009	Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use	Wynne W. Chin, Norman Johnson, and Andrew Schwarz	72
	MISQ	2009	A Meta-Analysis of the Role of Environment-Based Voluntariness in Information Technology Acceptance	Jiming Wu and Albert Lederer	73
	MISQ	2009	Why Break the Habit of a Lifetime? Rethinking the Roles of Intention, Habit, and Emotion in Continuing Information Technology Use	Ana Ortiz de Guinea and M. Lynne Markus	74
	MISQ	2010	Vital Signs for Virtual Teams: An Empirically Developed Trigger Model for Technology Adaptation Interventions	Dominic M. Thomas and Robert P. Bostrom	75
	MISQ	2010	The Other Side of Acceptance: Studying the Direct and Indirect Effects of Emotions on Information Technology Use	Anne Beaudry and Alain Pinsonneault	76
	MISQ	2011	Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology	Viswanath Venkatesh, James Y. L. Thong, and Xin Xu	77
	MISQ	2013	A Longitudinal Study of Herd Behavior in the Adoption and Continued Use of Technology	Heshan Sun	78
	MISQ	2013	Addressing the Personalization-Privacy Paradox: An Empirical Assessment from a Field Experiment on Smartphone Users	Juliana Sutanto, Elia Palme, Chuan-Hoo Tan, and Chee Wei Phang	79
	MISQ	2013	An Investigation of Information Systems Use Patterns: Technological Events as Triggers, the Effect of Time, and Consequences for Performance	Ana Ortiz de Guinea and Jane Webster	80
	MISQ	2014	Reliability Generalization of Perceived Ease of Use, Perceived Usefulness, and Behavioral Intentions	Traci J. Hess, Anna L. McNab, and K. Asli Basoglu	81

MIS Journal Rating

Rank - Source	Journal	Year	Title	Author	Cite
MIS Journal Rating	CACM	2005	Investigating wireless web adoption patterns in the U.S.	Arvind Malhotra, Albert H. Segars	82
	CACM	2005	Trust in e-commerce	A.F. Salam, Lakshmi Iyer, Prashant Palvia, Rahul Singh	83

CACM	2006	Mobile data service fuels the desire for uniqueness	Se-Joon Hong, Kar Yan Tam, Jinwoo Kim	84
CACM	2007	The four incremental steps toward advanced mobile service adoption	Ioanna D. Constantiou, Jan Damsgaard, Lars Knutsen	85
CACM	2007	Evolution and emerging issues in mobile wireless networks	Sasha Dekleva, J.P. Shim, Upkar Varshney, Geoffrey Knoerzer	86
CACM	2009	A Relevancy-Based Services View for Driving Adoption of Wireless Web Services in the U.S.	Arvind Malhotra, Claudia Kubowicz Malhotra	87
CACM	2009	Why IS Management is In Trouble and How to Save It: lessons learned in the automotive industry	By Arik Ragowsky, David Gefen	88
MS	2010	An Empirical Analysis of Mobile Voice Service and SMS: A Structural Model	Youngsoo Kim, Rahul Telang, William B. Vogt, Ramayya Krishnan	89
MS	2011	An Empirical Analysis of User Content Generation and Usage Behavior on the Mobile Internet	Anindya Ghose, Sang Pil Han	90
AI	2012	Generating diverse plans to handle unknown and partially known user preferences	Tuan Anh Nguyen, Minh Do, Alfonso Emilio Gerevini, Ivan Serina, Biplav Srivastava, Subbarao Kambhampati	91
AI	2012	Towards mobile intelligence: Learning from GPS history data for collaborative recommendation	Vincent W. Zheng, Yu Zheng, Xing Xie, Qiang Yang	92
DSJ	2007	Usability of Online Services: The Role of Technology Readiness and Context∗	Mitzi M. Montoya-Weiss	93
DSJ	2008	Technology Acceptance Model 3 and a Research Agenda on Interventions	Viswanath Venkatesh and Hillol Bala	94
DSJ	2008	Understanding the Determinants of Service Channel Preference in the Early Stages of Adoption: A Social Cognitive Perspective on Online Brokerage Services	Clayton Arlen Looney, Asli Yagmur Akbulut and Robin S. Poston	95
DSJ	2009	The Value to the Customer of RFID in Service Applications*	Gregory R. Heim, William R. Wentworth Jr. and Xiaosong (David) Peng	96
DSJ	2010	The Effect of Perceived Novelty on the Adoption of Information Technology Innovations: A Risk/Reward Perspective	John D. Wells, Damon E. Campbell, Joseph S. Valacich and Mauricio Featherman	97
DSJ	2014	Adoption of Mobile Telephony in Rural India: An Empirical Study	Ruchita Gupta and Karuna Jain	98
DSJ	2014	Supplier Selection Behavior Under Uncertainty: Contextual and Cognitive Effects on Risk Perception and Choice	Thomas J. Kull*, Adegoke Oke andKevin J. Dooley	99
HBR	-	-	-	0
IEEE Tr.	2006	Design, development, and assessment of mobile applications: the case for problem-based learning	Massey, A.P. ; Ramesh, V. ; Khatri, V.	100
IEEE Tr.	2008	Consumer Acceptance of RFID Technology: An Exploratory Study	Muhammad Muazzem Hossain and Victor R. Prybutok,	101
IEEE	2009	Micro Factors Influencing the Attitudes toward and the Use of a Mobile	Kaba, B. ; N'Da, K. ; Meso, P. ; Mbarika, V.	102

	Tr.		Technology: A Model of Cell-Phone Use in Guinea		
	IEEE Tr.	2012	Factors influencing quality of experience of commonly used mobile applications	Ickin, S. ; Wac, K. ; Fiedler, M. ; Janowski, L. ; Jin-Hyuk Hong ;Dey, A.K.	103
	IEEE Tr.	2012	Mobile application stores: success factors, existing approaches, and future developments	Cuadrado, F. ; Dueñas, J.C.	104
	IEEE Tr.	2013	Identifying User Experience Dimensions for Mobile Incident Reporting in Urban Contexts	Winckler, M. ; Bach, C. ; Bernhaupt, R.	105
	AIMag	2010	User Acceptance of Micro-blogging in the Enterprise	un Zhang, Yan Qu, Derek Hansen	106
	DSS	2005	The Social–Economic–Psychological model of technology adoption and usage: an application to online investing	Prabhudev Konana, Sridhar Balasubramanian	107
	DSS	2006	Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet	SeJoon Hong, James Y.L. Thong, Kar Yan Tam	108
	DSS	2011	Predicting consumer decisions to adopt mobile commerce: Cross country empirical examination between China and Malaysia	Alain Yee-Loong Chong, Felix T.S. Chan, Keng-Boon Ooi	109
	DSS	2012	Three decades of research on consumer adoption and utilization of electronic banking channels: A literature analysis	Hartmut Hoehle, Eusebio Scornavacca, Sid Huff	110
	DSS	2012	The effects of location personalization on individuals' intention to use mobile services	Shuk Ying Ho	111
	DSS	2012	IT innovation adoption by enterprises: Knowledge discovery through text analytics	Rahul C. Basole a, C. David Seuss b , William B. Rouse	112
	DSS	2013	How old are you really? Cognitive age in technology acceptance	Se-Joon Hong, Carrie Siu Man Lui, Jungpil Hahn, Jae Yun Moon, Tai Gyu Kim	113
	DSS	2013	A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention	Young Hoon Kim a , Dan J. Kim a, , Kathy Wachter	114
	I&M	2005	Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation	Matthew K.O. Lee, , Christy M.K. Cheung, Zhaohui Chen	115
	I&M	2006	Organizational size and IT innovation adoption: A meta-analysis	Gwanhoo Lee, Weidong Xia	116
	I&M	2006	Determinants of adoption of High Speed Data Services in the business market: Evidence for a combined technology acceptance model with task technology fit model	Margherita Pagani	117
	I&M	2007	User acceptance of wireless short messaging services: Deconstructing perceived value	Ofir Turel, Alexander Serenko, Nick Bontis	118
	I&M	2008	The effects of perceived risk and technology type on users' acceptance of technologies	Il Im, Yongbeom Kim, Hyo-Joo Han	119
	I&M	2009	The impact of use context on mobile services acceptance: The case of mobile	Niina Mallat, Matti Rossi, Virpi Kristiina	120

			ticketing ☆	Tuunainen, Anssi Öörni	
	I&M	2012	A meta-analysis of relationships between organizational characteristics and IT innovation adoption in organizations	Mumtaz Abdul Hameed, Steve Counsell, Stephen Swift	121
	I&M	2013	Consumers' adoption of information services	Brad McKenna a , Tuure Tuunanen b, , Lesley Gardner a	122
	JCSS	-	-	-	-
	SMR	-	-	-	-
	CAIS	2007	Wireless Telecommunications Issues: Cell Phone TV, Wireless Networks in Disaster Management, Ubiquitous Computing, and Adoption of Future Wireless Applications	Authors: J.P. Shim, Upkar Varshney, Sasha Dekleva, Robert C. Nickerson	123
	CAIS	2008	Context Counts: Effects of Work versus Non-Work Context on Participants' Perceptions of Fit in E-mail versus Face-to-Face Communication	Authors: E. V. Wilson, Steven D. Sheetz	124
	CAIS	2009	User-Centered Context-Aware Mobile Applications—The Next Generation of Personal Mobile Computing	Dongsong Zhang, Boonlit Adipat, Yaser Mowafi	125
	CAIS	2011	What Determines Actual Use of Mobile Web Browsing Services? A Contextual Study in Korea	Haejung Yun, Choong C. Lee, Byung Geun Kim, William J. Kettinger	126
	CAIS	2014	A Consumer Perspective on Mobile Service Platforms: A Conjoint Analysis Approach	Shahrokh Nikou, Harry Bouwman, Mark de Reuver	127

National Journal Rating Consolidated Tier

Rank - Source	Journal	Year	Title	Author	Cite
National Journal Rating Consolidated Tier	B&IT	2007	End-user adoption of animated interface agentsin everyday work applications	Alexander Serenko, Nick Bontis & Brian Detlor	128
	B&IT	2008	User acceptance of context-aware services: self-efficacy, user innovativeness and perceived sensitivity on contextual pressure	O. Kwon, K. Choi & M. Kim	129
	B&IT	2008	Factors influencing feature usage in work-related communication	G. Lindgaard & S. Narasimhan	130
	B&IT	2011	An empirical examination of users' post-adoption behaviour of mobile services	Tao Zhou	131
	B&IT	2011	Exploring factors influencing mobile users' intention to adopt multimedia messaging service	Shuchih Ernest Chang & Ying-Hui Vera Pan	132
	B&IT	2013	Personality and technology acceptance: the influence of personality factors on the core constructs of the Technology Acceptance Model	Gunnvald B. Svendsen, Jan-Are K. Johnsen, Live Almås-Sørensen & Joar Vittersø	133
	B&IT	2014	Testing the moderating role of need for cognition in smartphone adoption	Hichang Cho & Byungho Park	134

	BR&I	-	-	-	-
	ECR &A	2009	Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit	Ming-Chi Lee	135
	ECR &A	2011	The role of psychological traits and social factors in using new mobile communication services	Kyung Kyu Kim, Ho Kyoung Shin, Beomsoo Kim	136
	HCI	2014	What Designers Talk About When They Talk About Context	Jared S. Bauer, Mark W. Newman & Julie A. Kientz	137

ACM Digital Library

Rank - Source	Journal	Year	Title	Author	Cite
ACM Digital Library	ICEC	2014	Value Added Services and Adoption of Mobile Payments	Christel Augsburg, Jonas Hedman	138
	SIGCHI	2014	Leakiness and creepiness in app space: perceptions of privacy and mobile app use	Irina Shklovski, Scott D. Mainwaring, Halla Hrund Skúladóttir, Höskuldur Borgthorsson	139
	CHI EA	2014	Measuring user experience through future use and emotion	Celeste Lyn Paul, Anita Komlodi	140
	SIGCHI	2014	Effects of security warnings and instant gratification cues on attitudes toward mobile websites	Bo Zhang, Mu Wu, Hyunjin Kang, Eun Go, S. Shyam Sundar	141
	CSCW	2014	The motivations and experiences of the on-demand mobile workforce	Rannie Teodoro, Pinar Ozturk, Mor Naaman, Winter Mason, Janne Lindqvist	142
	WebMedia	2013	Evaluation of the influence of contextual factors on the interactions with applications for smartphones	Artur Henrique Kronbauer, Celso Alberto Saibel Santos	143
	TOIT	2013	Investigating Users' Perspectives of Web Single Sign-On: Conceptual Gaps and Acceptance Model	San-Tsai Sun, Eric Pospisil, Ildar Muslukhov, Nuray Dindar, Kirstie Hawkey, Konstantin Beznosov	144
	ASIST	2013	Factors affecting the adoption of Facebook by information professionals	Noa Aharony	145
	SAICIT	2013	Ease of use and usefulness of webinars in an open distance learning environment: an activity theory perspective	T. M. van der Merwe, M. E. van Heerden	146
	UbiComp	2013	On the stability of context prediction	Immanuel König, Bernd Niklas Klein, Klaus David	147
	UbiComp	2013	Exploring the impact of trust information visualization on mobile application usage	Zheng Yan, Conghui Liu, Valtteri Niemi, Guoliang Yu	148
	SIGMIS	2013	Privacy risk versus socialness in the decision to use mobile location-based applications	Darren Roback, Robin L. Wakefield	149
	TOCHI	2013	Influence of personality on satisfaction with mobile phone services	Rodrigo De Oliveira, Mauro Cherubini,	150

				Nuria Oliver	
MUM '	2012	Exploring user preferences for privacy interfaces in mobile sensing applications		Delphine Christin, Andreas Reinhardt, Matthias Hollick, Kai Trumpold	151
MUM '	2012	What influences users' decisions to take apps into use?: a framework for evaluating persuasive and engaging design in mobile Apps for well-being		Ting-Ray Chang, Eija Kaasinen, Kirsikka Kaipainen	152

EBSCO

Source	Journal	Year	Title	Author	Cite
EBSCO	B&IT	2008	The effects of information quality of mobile information services on user satisfaction and service acceptance-empirical evidence from Finland.	Koivumaki, T.; Ristola, A.; Kesti, M.	153
	JPM	2009	Consumer Adoption of Mobile Internet Services: An Exploratory Study.	Pingjun Jiang	154
	JOC	2011	Theoretical Intersections Among Social Influences, Beliefs, and Intentions in the Context of 3G Mobile Services in Singapore: Decomposing Perceived Critical Mass and Subjective Norms	Cho, Hichang.	155
	B&IT	2012	Affective and social determinants of mobile data services adoption.	Karaiskos, Dimitrios C.; Drossos, Dimitris A.; Tsiaousis, Alexandros S.; Giaglis, George M.; Fouskas, Konstantinos G.	156
	IJLIS	2009	A Critical Review of User Acceptance Research in the Area of Mobile Services.	Platzer, Elisabeth.	157
	JASIS	2012	Sociospatial context and information behavior: Social exclusion and the influence of mobile information technology.	Mervyn, Kieran; Allen, David K.	158
	CP&B	2008	Understanding Individual Adoption of Mobile Booking Service: An Empirical Investigation.	Wang, Yi-Shun; Liao, Yi-Wen	159
	IJHCI	2005	Use Contexts for the Mobile Internet: A Longitudinal Study Monitoring Actual Use of Mobile Internet Services.	Inseong Lee; Jaesoo Kim; Jinwoo Kim. International Journal of Human-Computer Interaction	160
	JICM	2010	The Effects of Technology Self-Efficacy and Innovativeness on Consumer Mobile Data Service Adoption between American and Korean Consumers.	Yang, Kiseol.	161
	B&IT	2007	User acceptance of context-aware services: self-efficacy, user innovativeness and perceived sensitivity on contextual pressure.	Kwon, O.; Choi, K.; Kim, M.	162
	B&IT	2011	Exploring factors influencing mobile users' intention to adopt multimedia messaging service.	Shuchih Ernest Chang; Ying-Hui Vera Pan.	163
	JIC	2008	The Influence of Gender on New Technology Adoption and Use-Mobile Commerce.	Suhong Li; Richard Glass; Hal Records.	164
	IJHCI	2006	Culturability in Mobile Data Services: A Qualitative Study of the Relationship Between Cultural Characteristics and User-Experience Attributes.	Boreum Choi; Inseong Lee; Jinwoo Kim.	165

ProQuest

Source	Journal/ Conference Paper	Year	Title	Author	Cite
ProQuest	ET&S	2010	User Acceptance of Mobile Knowledge Management Learning System: Design and Analysis	Chen, Hong-Ren; Huang, Hui-Ling.	166
	JET	2013	The Innovativeness and Self-Efficacy Predict the Acceptance of Using iPad2 as a Green Behavior by the Government's Top Administrators	Hong, Jon-Chao; Hwang, Ming-Yueh; Ting, Tzu-Yun; Tai, Kai-Hsin; Lee, Chih-Chin.	167
	B&IT	2013	Exploring the User Experience of Three-Dimensional Virtual Learning Environments	Shin, Dong-Hee; Biocca, Frank; Choo, Hyunseung.	168
	CWIS	2010	Mobile Phone Appropriation of Students and Staff at an Institution of Higher Learning	Karim, Nor Shahriza Abdul; Oyebisi, Ishaq Oyefolahan; Mahmud, Murn	169
	EDUCAUSE Review	2011	Mobile Perspectives: On E-Books. E-Reading--The Transition in Higher Education	McCarthy, David.	170
	CWIS	2011	Mobile Student Information System	Asif, Muhammad; Krogstie, John.	171
	TOJDE	2011	Users' Behavior towards Ubiquitous M-Learning	Suki, Norazah Mohd; Suki, Norbayah Mohd.	172

Google Scholar

Rank - Source	Journal	Year	Title	Author	Cite
Google Scholar	I&M	2006	Design aesthetics leading to m-loyalty in mobile commerce	D Cyr, M Head, A Ivanov -	173
	IJMC	2006	Predicting consumer acceptance in mobile services: empirical evidence from an experimental end user environment	T Koivumaki, A Ristola, M Kesti -	174
	ISR	2006	Understanding the adoption of multipurpose information appliances: the case of mobile data services	SJ Hong, KY Tam	175
	SS	2006	The impact of use situation and mobility on the acceptance of mobile ticketing services	N Mallat, M Rossi, VK Tuunainen	176
	I&M	2006	An examination of the determinants of customer loyalty in mobile commerce contexts	HH Lin, YS Wang	177
	T&I	2005	Exploring factors affecting the adoption of mobile commerce in Singapore	KCC Yang	178
	DSS	2010	Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services	X Luo, H Li, J Zhang, JP Shim	179
	CIHB	2010	An empirical examination of factors influencing the intention to use mobile payment	C Kim, M Mirusmonov, I Lee	180

	SRB	2009	An extension of technology acceptance model: Analysis of the adoption of mobile data services in China	J Qi, L Li, Y Li, H Shu	181
	IJICIC	2011	RESEARCH OF INFLUENCES FOR M-COMMERCE SERVICE TO CHINESE FARMERS' CONSUMPTION NETWORK	Yunfu Huo; , Bo Zhang, Lin Ma and Ping Zhang	182
	IJHCS	2005	An empirical comparison of use-in-motion evaluation scenarios for mobile computing devices	Leon Barnarda, Ji Soo Yia, Julie A. Jackoa, , Andrew Searsb,	183
	ECR	2012	Modeling users' acceptance of mobile services	Theodora Zarmpou · Vaggelis Saprikis · Angelos Markos · Maro Vlachopoulou	184
	CPB	2008	Applying the Technology Acceptance Model and Flow Theory to Cyworld User Behavior: Implication of the Web2.0 User Acceptance	DONG-HEE SHIN, and WON-YOUNG KIM,	185
	JCB	2008	Extending the technology acceptance model to mobile telecommunication innovation: The existence of network externalities	Chih-Chien Wang', Shao-Kang Lo, and Wenchang Fang	186
	GIQ	2012	User acceptance of mobile e-government services: An empirical study	Shin-Yuan Hung , Chia-Ming Chang , Shao-Rong Kuo	187
	T&I	2014	Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model	Eunil Park Seoin Baek, Jay Ohm, Hyun Joon Chang	188
	IMDS	2013	Role of gender on acceptance of mobile payment	Francisco Jose´ Lie´bana-Cabanillas, Juan Sa´nchez-Ferna´ndez and Francisco Mun˜oz-Leiva	189
	T&I	2013	Social acceptance oflocation-based mobile government services for emergency management	Anas Aloudat , Katina Michael, Xi Chen , Mutaz M. Al-Debei	190
	T&I	2014	Factors influencing users' employment of mobile map services	Eunil Park, Jay Ohm	191
	IJIM	2014	The moderating effect of experience in the adoption of mobilepayment tools in Virtual Social Networks: The m-Payment AcceptanceModel in Virtual Social Networks (MPAM-VSN)	Francisco Liébana-Cabanillas, Juan Sánchez-Fernández, Francisco Mu˜noz-Leiva	192
	CHB	2012	The impact of distractions on the usability and intention to use mobile devices for wireless data services	Constantinos K. Coursaris Khaled Hassanein, Milena M. Head , Nick Bontis	193
	JEIM	2008	Explaining the adoption of transactional B2C mobile commerce	Mohamed Khalifa and Kathy Ning Shen	194
	PUC	2011	Effect of use contexts on the continuous use of mobile services: the case of mobile games	Ting-Peng Liang • Yi-Hsuan Yeh	195
	IJTR	2008	A Model of Traveller Acceptance of	Dae-Young Kim, Jungkun Park and	196

			Mobile Technology	Alastair M. Morrison	
	Bled Ec	2005	Adoption of Mobile Services across Different Technologies	Christer Carlsson, Kaarina Hyvönen, Petteri Repo and Pirkko Walden	197
	I&M	2007	Determinants of adoption of mobile games under mobile broadband wireless access environment	Imsook Ha , Youngseog Yoon, Munkee Choi	198
	ECRA	2005	Diffusion and success factors of mobile marketing	Arno Scharl a, Astrid Dickinger, Jamie Murphy	199
	CHB	2009	Towards an understanding of the consumer acceptance of mobile wallet	Dong-Hee Shin	200
	BJET	2009	Investigating the determinants and age and gender differences in the acceptance of mobile learning	Yi-Shun Wang, Ming-Cheng Wu and Hsiu-Yuan Wang	201
	DSS	2007	Value-based Adoption of Mobile Internet: An empirical investigation	Hee-Woong Kim, Hock Chuan Chan, Sumeet Gupta	202
	JTAECR	2007	A Conceptual Framework and Propositions for the Acceptance of Mobile Services	Sally Rao and Indrit Troshani	203
	VTT Publications	2005	User acceptance of mobile services – value, ease of use, trust and ease of adoption	Eija Kaasinen	204
	IJMHCI	2008	User Acceptance of Mobile Services	Eija Kaasinen	205
	I&M	2006	A meta-analysis of the technology acceptance model	William R. King, Jun He	206

Computing Surveys

Rank - Source	Journal	Year	Title	Author	Cite
Computing Surveys	ACM (CS)	2015	Securing Android: A Survey, Taxonomy, and Challenges.	Tan, D.J., Chua, T.W. and Thing, V.L.	207
	ACM (CS)	2015	Anticipatory Mobile Computing: A Survey of the State of the Art and Research Challenges.	Pejovic, V. and Musolesi, M.	208
	ACM (CS)	2013	Survey and Analysis of Current Mobile Learning Applications and Technologies.	Pereira, O.R. and Rodrigues, J.J.	209
	ACM (CS)	2013	A Survey on Smartphone-Based Systems for Opportunistic User Context Recognition.	Hoseini-Tabatabaei, S.A., Gluhak, A. and Tafazolli, R.	210
	ACM (CS)	2012	A Survey of Context Data Distribution for Mobile Ubiquitous Systems.	Bellavista, P., Corradi, A., Fanelli, M. and Foschini, L.	211

Appendix C: Sources From Online Databases

ACM Digital Library

Source	Journal/ Conference paper	Year	Title	Cite
ACM Digital Library	ICEC	2014	Value Added Services and Adoption of Mobile Payments	[138]
	SIGCHI	2014	Leakiness and creepiness in app space: perceptions of privacy and mobile app use	[139]
	CHI EA	2014	Measuring user experience through future use and emotion	[140]
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	CWIS	2010	Mobile Phone Appropriation of Students and Staff at an Institution of Higher Learning	169

	EDUCAUSE Review	2011	Mobile Perspectives: On E-Books. E-Reading--The Transition in Higher Education	170
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	JICM	2010	The Effects of Technology Self-Efficacy and Innovativeness on Consumer Mobile Data Service Adoption between American and Korean Consumers.	[161]
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	JIC	2008	The Influence of Gender on New Technology Adoption and Use-Mobile Commerce.	[164]
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	CPB	2008	Applying the Technology Acceptance Model and Flow Theory to Cyworld User Behavior: Implication of the Web2.0 User Acceptance	DONG-HEE SHIN, and WON-YOUNG KIM,	185
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	T&I	2014	Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model	Eunil Park Seoin Baek, Jay Ohm, Hyun Joon Chang	188
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T&I	2013	Social acceptance of location-based mobile government services for emergency management	Anas Aloudat , Katina Michael, Xi Chen , Mutaz M. Al-Debei	190
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IJTR	2008	A Model of Traveller Acceptance of Mobile Technology	Dae-Young Kim, Jungkun Park and Alastair M. Morrison	196
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JTAECR	2007	A Conceptual Framework and Propositions for the Acceptance of Mobile Services	Sally Rao and Indrit Troshani	203
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IJMHCI	2008	User Acceptance of Mobile Services	Eija Kaasinen	205
I&M	2006	A meta-analysis of the technology acceptance model	William R. King, Jun He	206

Appendix D: Taxonomy of Mobile Service Factors

Classification	Factors	[105], [151], [152], [173]	[77], [109], [110], [117], [126]	[94],[98],[110],[111], [126],[154],[191]	[32],[42],[152]	[12],[47],[58],[187]	[31]	[14], [16], [33], [47], [49], [77], [201]	[45], [56], [94], [101], [109],[115], [128], [132], [136], [159],[161], [163],[167], [180], [182],[187], [190],[192], [194],[200]	[9],[10]	[110], [117], [118], [136], [152], [154], [172], [175], [193], [194], [202]	[58], [60], [98]	[49], [94]	[149]	[4], [26], [37], [45] [76], [77], [84], [94], [114], [115], [110], [128], [145], [149], [152], [157], [172], [173], [181], [188], [191], [198], [202], [203]	[86], [98], [180], [189], [191]	[184]	[97], [111]	[125], [129], [162]	[110]
Mobile Services	Visual & Aesthetic Appeal	●									●				●					
	Price of Service		●	●		●		●	●	●	●	●			●	●				●
	Service Output Quality		●	●	●				●		●	●	●		●					●
	Service Information Quality				●															
	Service Interaction Intensity					●			●											
	Personalisation						●													
	Cognitive Complexity	●	●	●		●		●	●		●	●	●		●	●				●
	Convenience & Advantage of the Service		●	●		●			●		●	●			●	●				●
	Additional Customer Support									●										

	Service Value	•	•						•		•					•					•
	Service Risk		•	•		•		•	•		•		•		•	•	•	•	•		•
	Job Relevance			•		•		•	•		•		•	•		•	•				•
	Socialness	•									•				•	•					
	Service Enjoyment	•	•	•	•			•	•		•				•	•	•				•
	Service Mobility		•	•					•		•		•			•	•				
	Service Functionality				•												•				
	Novelty								•								•	•			
	Context Sensitivity																		•		
	Intuitiveness	•	•						•		•						•				•

Appendix E: Taxonomy of Context of Use Factors

Context of Use	Factors	[6], [19], [26], [37], [49],[109], [145],[164], [174],[203]	[6], [26], [37], 49], [109], 164],[174]	[21], [49], 94], 174], [203]	[109], [174]	[14], [52], [76], [94]	[3]	[66], [94], 188], [203]	[121], [154], [196]	[10], [66], [97], [110], [115],[126], [136], [161], [172], [181],[188], [189],[190],[195],[200]	[2], [26], [34]	[1], [4]	[34], [94], [98], [203]	[29], [56], [97], [128], [129],[145], [161], [162], [167],	[26], [34], [84], [175]	[13], [24], [93], [133], [145], [154]	[14], [18], [45], [48], [59], [60],[83], [109], [141], [148],[152],[164],[182],[184],[187],[189],[190]	[77], [110]	[102], [120], [176], [183], [188]	[49], [66], [95], [110], [129], [136], [161], [162], [167],	[66], [94], [110], [126], [136], [189], [195]	[58]	[45]	[58], [182]	[26], [32], [34], [98], [110], [175]	[23], [110]	[32], [53], [126]	[45], [97], [99], [101], [110], [117], [119], [126], [135],	[26], [28], [33], [34], [35], [37],[38], [44], [49], [56], [77],	[15]	[95], [98], [110]	[99]	[116], [121]	[10], [61], [121]	[101], [165]
User	Age	•	•	•	•	•							•	•	•	•	•		•		•							•	•	•					
	Gender	•	•	•	•	•							•	•		•	•		•		•							•	•						
	Previous Experience	•	•	•	•	•		•					•	•							•							•						•	
	Educational Level	•	•	•	•	•		•					•	•						•								•	•						
	Technology Anxiety	•		•		•		•					•				•																		
	User Role			•			•																				•								
	Control	•			•			•			•	•	•					•	•	•					•	•		•	•		•				
	Access Barriers	•		•		•			•							•					•				•			•	•		•				
	Attitude	•		•	•	•		•	•	•			•	•			•	•	•	•								•	•		•				
	Enjoyment	•	•	•		•		•		•	•	•	•	•	•		•	•	•	•					•	•		•	•		•				

169

	Cognitive Absorption									•					•									•				
	Self-Image	•		•				•		•		•	•	•		•			•			•		•	•		•	
	Personal Innovativeness	•	•	•	•	•		•		•		•	•		•	•			•					•				
	Need for Uniqueness (NU)	•	•						•		•		•							•					•				
	User Personality Type	•									•		•																
	Risk Aversion	•	•		•				•		•				•	•		•	•	•	•	•	•	•	•		•	
	Habit								•						•	•		•	•			•	•		•	•	•		
	User Mobility							•								•			•			•			•				
	Self-Efficacy	•		•		•		•		•	•		•		•	•		•	•			•	•		•	•	•		
	Subjective Norm			•		•		•		•					•	•		•	•			•	•	•	•	•		•	
Task	Task Complexity																		•		•		•						
	Urgency of Task															•							•						
	Importance of Task																												
	Task Type			•																•					•				
Technology	Accessibility	•	•							•	•	•		•		•	•		•	•		•	•	•	•		•	
	Technology Complexity									•						•	•		•	•		•	•		•		•	
	Compatibility			•						•		•	•			•	•	•	•	•		•	•	•	•	•	•	
	System Quality			•	•			•	•	•		•				•	•		•			•	•	•	•	•	•	
	Portability							•		•	•		•			•						•		•	•	•	•	
	Relative Advantage			•						•		•	•			•	•	•	•	•		•	•		•	•	•	
	Navigation																					•		•				
	Security			•				•		•		•				•	•		•	•	•	•	•	•	•	•	•	
	Privacy			•	•			•		•		•			•	•	•		•	•		•	•	•	•	•	•	

170

Environ ment	Social Influence	•	•	•	•	•				•	•		•	•	•	•	•	•	•	•	•			•		•	•		•			
	Awareness of the Service									•			•			•		•	•		•	•	•	•	•	•		•			•
	Trialability	•	•	•						•					•	•		•	•		•	•	•	•	•		•				
	Importance of Sourcing the Service																							•				•				
	Organisational Size						•	•																						•	•	
	Organisational Readiness	•		•	•			•	•		•	•		•	•	•	•	•	•			•		•	•				•	•	
	Cultural Influences																															•
	Use Situation												•			•			•		•											

Appendix F: AHP Template - Priortisation of Mobile Service Factors

\multicolumn{4}{}{Criteria}			More Important?	Scale
i	j	A	B	- A or B	(1-9)
1	2	Service Information Quality	Trustworthiness		
1	3		Convenience & Advantage of the Service		
1	4		Service Risk		
1	5		Visual & Aesthetic Appeal		
1	6		Service Cognitive Complexity		
1	7		Service Output Quality		
1	8		Additional Support		
2	3	Trustworthiness	Convenience & Advantage of the Service		
2	4		Service Risk		
2	5		Visual & Aesthetic Appeal		
2	6		Service Cognitive Complexity		
2	7		Service Output Quality		
2	8		Additional Support		
3	4	Convenience & Advantage of the Service	Service Risk		
3	5		Visual & Aesthetic Appeal		
3	6		Service Cognitive Complexity		
3	7		Service Output Quality		
3	8		Additional Support		
4	5	Service Risk	Visual & Aesthetic Appeal		
4	6		Service Cognitive Complexity		
4	7		Service Output Quality		
4	8		Additional Support		
5	6	Visual & Aesthetic Appeal	Service Cognitive Complexity		
5	7		Service Output Quality		
5	8				

			Additional Support		
6	7	Service Cognitive Complexity	Service Output Quality		
6	8		Additional Support		
7	8	Service Output Quality	Additional Support		
1	9	Service Information Quality	Intuitiveness		
1	10		Novelty		
2	9	Trustworthiness	Intuitiveness		
2	10		Novelty		
3	9	Convenience & Advantage of the Service	Intuitiveness		
3	10		Novelty		
4	9	Service Risk	Intuitiveness		
4	10		Novelty		
5	9	Visual & Aesthetic Appeal	Intuitiveness		
5	10		Novelty		
6	9	Service Cognitive Complexity	Intuitiveness		
6	10		Novelty		
7	9	Service Output Quality	Intuitiveness		
7	10		Novelty		
8	9	Additional Support	Intuitiveness		
8	10		Novelty		
9	10	Intuitiveness	Novelty		

Appendix G: AHP Template- Priortisiation of Context of Use Factors

Criteria					More Important?	Scale
i	j	A		B	- A or B	(1-9)
1	2	Use Situation		Users' Previous Experience		
1	3			User Access Barriers		
1	4			Awareness of the Service		
1	5			Social Influence		
1	6			User Mobility		
1	7			Relative Advantage		
1	8			Task Urgency		
2	3	Users' Previous Experience		User Access Barriers		
2	4			Awareness of the Service		
2	5			Social Influence		
2	6			User Mobility		
2	7			Relative Advantage		
2	8			Task Urgency		
3	4	User Access Barriers		Awareness of the Service		
3	5			Social Influence		
3	6			User Mobility		
3	7			Relative Advantage		
3	8			Task Urgency		
4	5	Awareness of the Service		Social Influence		
4	6			User Mobility		
4	7			Relative Advantage		
4	8			Task Urgency		
5	6	Social Influence		User Mobility		
5	7			Relative Advantage		
5	8			Task Urgency		
6	7	User Mobility		Relative Advantage		
6	8			Task Urgency		
7	8	Relative Advantage		Task Urgency		
1	9	Use Situation		User's Risk Aversion		
1	10			Enjoyment		
2	9	Users' Previous Experience		User's Risk Aversion		
2	10			Enjoyment		
3	9	User Access Barriers		User's Risk Aversion		
3	10			Enjoyment		
4	9	Awareness of the Service		User's Risk Aversion		
4	10			Enjoyment		
5	9	Social Influence		User's Risk Aversion		
5	10			Enjoyment		
6	9	User Mobility		User's Risk Aversion		
6	10			Enjoyment		
7	9	Relative Advantage		User's Risk Aversion		
7	10			Enjoyment		
8	9	Task Urgency		User's Risk Aversion		
8	10			Enjoyment		
9	10	User's Risk Aversion		Enjoyment		

Appendix H: Mobile Service Questionnaire and Scale

MOBILE SERVICE FACTORS CATEGORISATION								
Influencing Factor	Question	No.	N/A	0-20	21-40	41-60	61-80	81-100
Trustworthiness	How would you score the service in terms of trustworthiness?			**Risky.** There are potential privacy threats and the service will not protect against these. (E.g. broken cryptography, weak server side controls, insufficient transport layer protection, etc.).		**Trustworthy.** There are potential privacy threats, however these have been considered and measures will be taken to prevent security breaches. (e.g. establishing strong passwords, secure encryption, remote wiping, etc.).	**Very trustworthy.** Personal information is well protected and secure; all possible measures will be taken to prevent security breaches.	
	How much control will the user have of their personal information? (E.g. enables the user to determine when, and to what extent, information held about them is communicated to others).			The user cannot manage personal data, even though personal data may be captured by the service.		The user cannot manage personal data, however the service will ask for permission to use any personal data if required. If personal information is passed on to others (e.g. advertising companies) it will be done in a secure manner.	The service will provide the capability for end users to control personal information (e.g. prompts; Facebook privacy options for your profile).	
Service Complexity	How much mental activity (e.g. thinking, remembering, looking, searching, etc.) is required to use the service?			A large volume of mental activity is required. (e.g. thinking, remembering, looking, searching, etc.).	A significant amount of mental activity is required. (e.g. thinking, remembering, looking, searching, etc.).	A moderate amount of mental and activity is required. (e.g. thinking, remembering, looking, searching, etc.).	A low amount of mental activity is required. (e.g. thinking, remembering, looking, searching, etc.).	Little or no mental activity is required. (e.g. thinking, remembering, looking, searching, etc.).

	How much physical activity (e.g. tapping, zooming, scrolling, data entry, etc.) is required to use the service?			A large volume of physical activity is required (e.g. tapping, zooming, scrolling, data entry, etc.).	A significant amount of physical activity is required (e.g. tapping, zooming, scrolling, data entry, etc.).	A moderate amount of physical activity is required (e.g. tapping, zooming, scrolling, data entry, etc.).	A low amount of physical activity is required (e.g. tapping, zooming, scrolling, data entry, etc.).	Little or no physical activity is required (e.g. tapping, zooming, scrolling, data entry, etc.).
	How much time pressure is put on the user due to the pace at which the service responds? (e.g. Ticketmaster, Ryanair, – countdown/ timeout).			A large volume of time pressure is put on the user (e.g. Frantic Pace - high level game).	A significant amount of time pressure is put on the user (e.g. Ticketmaster (countdown/timeout).	A moderate amount of time pressure is put on the user. (e.g. moderate pace).	A low amount of time pressure is put on the user (e.g. slow pace).	Little or no time pressure is put on the user (e.g. leisurely pace).
Convenience and Availability of the Service	How easily available will the service be?			The service is available for PC only. The user may be restricted to a particular location and time. (E.g. PDF Xchange Viewer).	The service is available on PC and also on some mobile platforms. (E.g. available on Android, not available on iOS (Tasker – Personalisation app).		This service will have a 'mobile only' strategy (e.g. dynamic pricing app), but can be accessed easily anytime, anywhere, as it will be available across all mobile platforms (e.g. iOS, Android, etc.).	The service will available across all platforms - PC & Mobile (e.g. Android, iOS, Blackberry, Windows, etc.) and as a result can be accessed any-time and anywhere.
Service Information Quality	To what degree will the information offered by the service be relevant for the user's task?			The information may not be relevant to the user's task and will need to be updated or obtained from other sources.		The information will be relevant to the users' task, however it may need to be updated (e.g. not up to date).	The information will be helpfully aligned with the requirements of the users' task. (e.g. enables the user to complete their task - the information will be very applicable).	
	To what degree is the information produced or consumed in a timely manner?			The information will have a time limit and consequently will not always provide timely data to the user.		The information will have a time limit; however the last known time of update will be displayed to the user to prevent supplying inaccurate information. (e.g. only relevant for a	The information will be up-dated regularly or will offer real-time data. (e.g. Google Maps -real time - current location).	

					certain time period).		
	To what degree is the information produced or consumed <u>reliable</u>?			The information may be obtained from an unknown source.	The information will be obtained from a known source or organisation, however their reputation is unknown.	The information will be obtained from a known source or organisation with a <u>good reputation</u>.	
	To what degree is the information required by the user to conduct their task <u>complete</u>?			Some information may be <u>incomplete</u> (e.g. <u>may not</u> be of sufficient depth and breadth for the user to complete their task).	The information will be <u>mainly complete.</u> (e.g. <u>moderate</u> depth and breadth of information for the user to complete their task).	All information <u>will</u> be present (e.g. <u>will</u> be of sufficient depth and breadth for the user to complete their task).	
Service Intuitiveness	To what degree is the service is natural or intuitive?			<u>**Unusable:**</u> The service will have intuitive attributes, but they may be contradictory, which may result in a confusing user's experience. The service may also lack most standard intuitive attributes and users may forget the interaction path.	<u>**Usable:**</u> The service will be;		<u>**Fully Intuitive**</u>: The service will be automatic (e.g. the service has all appropriate intuitive attributes. The user can achieve their goals without experimentation, assistance or training.
						(1) Sensible (it makes sense, even though it requires prior experience),	
						(2) Learnable (it will require quick thought or experimentation for the user to figure out on their own),	
						(3) Guessable (it will be usable with trial and error) and	
						4) Trainable (the users can learn how to use it through experience, documentation and training).	

Appendix I: Context of Use Questionnaire and Scale

Influencing Factor		Question	No.	N/A	0-20	21-40	41-60	61-80	81-100
User Factors	Users' Previous Experience	If the targeted user group have previously experienced a similar service (e.g. on desktop, or an existing service with the same goals), how would you rank their previous experience?			The target user group has a negative experience of a similar service, (e.g. on desktop or an existing service with the same goals).		The target user group has a neutral experience of a similar service, (e.g. on desktop or an existing service with the same goals).	The target user group has a positive experience of a similar service, (e.g. on desktop or an existing service with the same goals). For example: 'Yeti 'similar to 'Yelp' both have a good reputation.	
	User Accessibility and Access Barriers	How likely is the user to successfully accomplish the goals of the task? (e.g. this can be based on the users' background, such as IT experience, physical restrictions, social background, etc.)			The user is likely to have a 'poor' performance in relation to accomplishing the goals of the task, due to physical, external restrictions, etc.		The user is likely to have a mediocre performance.	The user is likely to have a 'good' performance in relation to accomplishing the goals of the task.	
		How hard will the user have to work to accomplish the goals of the task?			It is likely the user will work very hard to accomplish the goals of the task.		It is likely the user will work moderately hard to accomplish the goals of the task.	The user will not have to work hard to accomplish the goals of the task.	
		How anxious, discouraged or stressed may this service cause the user to feel?			The user is likely to become anxious, discouraged or stressed when using this service.		It is unknown if the user will become anxious, discouraged or stressed when using this service.	The user will not become anxious, discouraged or stressed when using this service.	

	Users Risk Aversion	How likely are potential users to share personal information? (e.g. downloading the service, entering personal information, creating a profile/account, etc.).			Unlikely to share personal information.	Likely to share personal information.	Willing to share personal information.
Environment (External) Factors	**Use Situation / Situational Impairments**	How compatible will the service be with use situations, where environmental factors may impact use? (e.g. low light, glare, ambient noise, vibration tremor, extreme temperatures, rainwater, uneven terrain, etc.).			The service may not be compatible with use situations, where environmental factors may impact use.	The service will be compatible with some (but not all) use situations, where environmental factors may impact use.	The service is compatible with all use situations, including those where environmental factors may impact use.
		How compatible will the service with use situations, where attentional factors may impact use? (e.g. physical obstacles, social interactions, divided attention, abrupt distraction, etc.).			The service may not be compatible to use situations where attentional factors may impact use.	The service will be compatible with some (but not all) use situations, where attentional factors may impact use.	The service is compatible with all use situations, including those where attentional factors may impact use.
		How compatible will the service be with use situations, where physical factors may impact use? (e.g. impeding clothing, baggage, occupied hands, user or device movement, posture or grip, user fatigue, etc.).			The service may not be compatible to use situations where physical factors may impact use.	The service will be compatible with some (but not all) use situations, where physical factors may impact use.	The service is compatible with all use situations, including those where physical factors may impact use.
	Awareness of the Service	How aware of the service will potential users be? (e.g. if there is a strategy in place to create awareness about the service to ensure users will be familiar with			User awareness can be classified as low. Functionalities such as messaging, media sharing are not integrated in the service and no strategy has been put in place to drive awareness.	User awareness can be classified as moderate. Functionalities such as messaging, media sharing, etc.	User awareness can be classified as high. Functionalities such as messaging, media sharing, etc. will be integrated in the service and a defined strategy

		the service.).			will be integrated and an initial awareness strategy drafted.	for spreading awareness of the service is established.
	Social Influence	What degree of social pressure will the user feel? (e.g. pressure from colleges to join a group network; Facebook, WhatsApp, LinkedIn, etc.).			Social pressure can be classified as low to moderate. There is no social component added to the service.	Social pressure can be classified as moderate to high, (e.g. the service may have open connectivity to popular social sites such as Facebook and LinkedIn, etc.).	Social pressure will be high. A social component has been added to the service (e.g. socially driven task, gamification, etc. & will be connected sites such as Facebook, LinkedIn, Google Apps, etc.).
Technology	**Relative Advantage**	If a similar service exists, to what degree is using the new service more advantageous to the user than the currently existing service.			There may be disadvantages associated with using this service, when compared to existing services (e.g. may take time to learn to use, costly compared to existing service, etc.).	The user is neither better off, nor worse off using this new service.	It is more advantageous to use this service than currently existing services (e.g. improved functionality, better quality information, improved security, etc.). For example, maybe the existing service involves human-to-human interaction and providing a mobile service can save the user a significant amount of time such as online banking apps –checking balance, etc.
Task	**Urgency of Task**	What is the urgency level of the task that the service will be supporting?			Urgent (e.g. emergency situation). The service may not be reliable enough to enable users to act swiftly, even when 'out of office' to achieve their goals.	Non Urgent.	Urgent (e.g. emergency situation). The service will enable the user to act swiftly, even when 'out of office' to achieve their goals.

Appendix J: CS1 Summary of Quotes from Transcripts

		CASE STUDY ONE
S	**L**	**Quote**
P1	23	"It encourages the team members to engage more with each other…with the others outside their area of expertise".
P3	24	"The team worked closely when defining the concept, to ensure that it is viable and realistic to achieve within the time and budget constraints".
P5	25	"Communication in the group was more integrated and equal… each member of the team got their point across opposed to just one or two, who can dominate the discussion".
P1	26	"Without the scoring system, it's more of a yes or no, whereas this forces you to discuss the concept in more depth...the list of questions got the team to think of members that needed to be brought into the discussion, who usually would not be contacted until later in the project".
P4	27	"I think that people are more aware, that other people have an opinion as well, I think that hopefully that we will be more open and have more information sharing in the team. I think that it could improve communication; if we all take the assessment instrument together every-time that we do this. I think that we should try this again next time and encourage the other members to have an input. I think that some members may have been very dominant, that is good, but I think that in general, ya in general this could lead to better communication among the team."
P3	28	"…far more information was generated than usual".
P1	29	"It's not just a general discussion; it requires you to have a far more complete conversation as it makes you consider every aspect and you must quantify your choice".
P4	30	"We haven't been thinking about all the various aspects we discussed today".
P3	31	"It organises and structures the relevant information, necessary to define the mobile concept".
FN	32	"After reviewing the adoption information (3D-Graph), the team stated that they had got an indication that they were making the right choices in term of defining the concept".
P3	33	"Using this you can recognise where errors may occur and whether or not you are making the right choices … if you are not, or if you get a low score, you could go back and address the areas that have faults before you move forward with the project".
P4	34	"It added transparency to the process as when you are now in the meeting you know who said what… it is easier to document who is responsible for each aspect… and therefore easier to supervise".
P2	35	"There is more structure in the process, when using the assessment instrument to define the concept, as from the very beginning you are scoping the project".
P6	36	"As there is set list of items that had to be discussed when defining the concept, we were less likely to go 'off-point'.
P2	37	"…it creates a dedicated time and space to discuss the concept before you go into the design stage".
P1	38	"It brings a formality to the process…it adds another step, for example, it is well established now that it would be foolish to start to develop the mobile app without considering the design, in a similar way the assessment instrument suggests that it would now be foolish to start without considering the innovation activities".
P6	39	"The process is more structured as there is a set task to complete, 1 answer all questions, 2 define the mobile concept, 3 review the scores and evaluate the outcome".
P1	40	'The assessment instrument adds to the thoroughness of the project…it ensures that the mobile concept is carefully and completely defined'.
P2	41	I don't think we get enough time to discuss what the user wants…, I don't think we go into enough detail. …So that is probably an area that we don't focus enough on, so we move on to the design stage very quickly."
P4	42	"We discussed many important factors that we would usually not discuss…".
P5	43	"It's clear that it is important to spend time on this… and be this thorough in this stage".
P1	44	"the scoring system in the assessment instrument makes it easier to define the concept, 'it

		allows you to see the alternative options and the consequences of choosing them … for example low vs high complexity and its impact on adoption".
P2	45	"…each member understood exactly what they would have to do and what their team members were responsible for".
P2	46	"I think that we would be in the design phase and we would have budgeted mostly towards design and development and later on realise that we need to devote more resources to getting information out to the users".
P2	47	"I think that some of the team members got more of an input into what should be considered in the first stages of the project … there were very specific points that we were forced to talk about".
P1	48	"…it gives you a better idea of the overall concept and the work we have to do before we get to a stage where we are confident going forward with the concept".
P3	49	"You have a better understanding …for example, if your concept is weak it will expose this"
P6	50	"Everyone felt they were all on board, we have a consistent understanding of the mobile concept".
P5	51	"Going into a meeting without a list of questions like those included in the assessment instrument would result in lost ideas… if there is no guide you can't be sure you are not forgetting something important".
P6	52	have seen from using the tool that that if we get a low score it may not be viable to put in the design time and effort to make it a reality, so it guides your choice as to what to do next."
FN	53	"The team was observed discussing each question in detail and then selecting the categories which best describes their concept". – Contextualisation and Calculation. "Furthermore, there were observed calculating and reviewing the potential adoption of their mobile concept". – Calculation.
FN	54	"Based on the score in the bubble chart (90 %) the team suggested that they would continue with the mobile concept, if they were basing their judgement solely on adoption".
P1	55	"It would be very appropriate because it would be very easy to start using and it would feed into the rest of the process and make the rest of the process easier. For example, if you document that process, it would contribute to the statement of work which would contribute to the design documents".
P1	56	"The scroll bars made answering the questions easier… and the graph with the adoption information was easy to understand".
P4	57	"The assessment instrument was easy to use… the scroll bars were convenient and the way the information came up immediately was useful and presented clearly".
P4	58	"It ensures that you define the concept prior to moving down the line to the design and development stages, where it may be more costly to make changes".
P4	59	"We discussed many important factors that we would usually not discuss… for example, the environmental constraints of the mobile app, and we talked about using the app in different scenarios that we wouldn't have talked about before".
P1	60	"It helps define the concept much better, it would be very easy to start using and it would feed in quite well with the rest of the activities in the innovation process".
P6	61	'the questions in the instrument would enable them to gather a far more comprehensive list of requirements and the graph indicates whether you're making the right choices'.
P1	62	"Although it adds an additional step to the process it is an overall time saver, as the formal meeting in the beginning of the project… will result in each member being up to-date and the individual (informal) discussions will be reduced".
P2	63	"It's necessary to invest this time in the early stages otherwise it may lead to problems in the later stages, for example, something coming up later that could have been recognised in the early stage, such as the amount of time we need to spend on creating awareness, that we saw today".
P2	64	"There were very specific points that we were forced to talk about …, I think that if we didn't add structure to the meeting everyone would be saying their own thing and it would be a bit all over the place".
P3	65	"If we came up with the concept internally within the team it would be fairly ad-hoc, some of us come up with ideas and then share those ideas with the rest of the team to see what they have to add to it, usually over a conversation."

P2	66	"This helps us to underhand the roles in the project and what is expected from each member. Once again, for example, usually we would be half way through the project when we tell the marketing guy that we need his resources… whereas, if we did this early on, we would know that we need his resources from the beginning".
P1	67	"It defiantly promotes communication, because you are scoring each question, it means that, there may be a broad agreement among the team that yes maybe we are on this factor, but they may not agree on the extent to which we are covered… well,… without the scoring system it's more of a yes or no we are covered on this factor but with the scoring system you go into more depth".

Appendix K: CS2 Summary of Quotes from the Transcripts

CASE STUDY TWO		
S	L	Quote
P7	21	"It's good to have a plan that you're supposed to be following, it takes the pressure off you as well as you feel more comfortable knowing that you have covered a lot of aspects and you're not forgetting somethings that you would in the informal meeting… like there has been many times when we leave the meeting and I think ahh… I should have talked about that".
P8	22	"By drawing people's attention to factors that they have not already considered… it opens a discussion that they may not have thought about. For example, the issue of sharing personal information… This is something no-one in the team would have brought up, but it is very important to consider… so I guess it facilitates the discussions in a more appropriate way, to open up discussions among the team members".
P7	23	"I think sometimes we might dismiss each other's point indirectly because we don't always have to agree, but here we do have to come to an agreement so it forces you to become more aware of the rest of the guy's point of view".
FN	24	"The team read each of the questions in the assessment instrument out loud and then began suggesting their opinions. This continued until each member of the team had voiced their opinion. Following this the team then debated which score to allocate to define the concept".
P7	25	"The language you use is important; it's just one set of terms and it's getting people to think in the same way. For example, for one of the questions (accessibility vs. availability) we were talking about two completely different things. It wasn't until we did the exercise together that we got an answer to the questions, this meant that we had to get to the bottom of it… figure out what the person really wanted to say".
P9	26	"It gives everyone on the team a common context to begin with. The members of the team come from different backgrounds and they have different areas of expertise, so they have different ideas as to what the concept should be. But if you, in the beginning of the process, have a common understanding and a common language, it makes discussing the mobile concept easier… so you know that you are talking about the same thing".
FN	27	"'The assessment instrument contains the necessary information, in a consistent manner, in order for the team to debate and allocate the scores required to define the mobile concept. This is evident as the team continued to debate the concept until they agreed on a score''.
T	28	''The assessment instrument supports the exchange of information in the innovation process, as the terminology included in the instrument is consistent, which resulted in the team discussing then concept in a common language''.
P7	29	"I found it clear, it was well explained, all of the sentences were short and snappy, as sometimes if you use a lot of terminology it is easy to loose people".
P9	30	"It would make sure that some questions were not left out … sometimes in the informal meetings, you could end up taking things for granted or you could end up not asking the right questions or even assume something and it might not actually be further developed or expanded upon. If you have a list of questions or a checklist at least… you are ensuring that those questions get answered opposed to an informal discussion where some questions may not get answered".
P7	31	"It makes you think in the same way and makes sure that nothing goes under the radar".
P7	32	''You're not forgetting something that you would in an informal meeting … like there have been many times when we leave the meeting and I think ahh… I should have talked about that''.
P9	33	"…these are usually things that come up in the later stages. I know this from experience with projects. In the early testing phase, these factors come up… whereas by asking them early on in the project, it reduces the workload as you don't end up going down a blind alley trying to implement something that the clients eventually want to adjust and we could have established that earlier".
FN	34	'The mobile service category information service was selected by the team, this then filters the data in the background of the assessment instrument, so that the adoption information only relevant for information services would come up'
P7	35	"Well, there are things that we would be considering, but not in such a structured way".
P8	36	"Using it will give people clarity… so instead of just having a vague idea and running with that, we have a step-by-step approach to follow…".
P9	37	"… If you start with a fairly informal process of innovation, often you will only see issues when you implement and start testing, whereas… when you go through a checklist earlier, like we did today… we may not have to use as many resources later on in development… as often development can be trial and error and if you rule out the obvious things earlier on it mean you rule out a lot of trial and error later on".

P7	38	''We usually get stuck, when defining the mobile concept, which means we can go off on tangents and then the initial idea becomes a number of different ideas from different perspectives, whereas when you have structured questions, like this it keeps you on point. We didn't jump off topic and it's nice to have something like this to refer back to … this was the main thing for me''.
P8	39	''It forces you to take a step by step approach as opposed to going ahead with a vague idea''
P7	40	"it was really good to have the questions laid out with the scales providing categories and examples… it helped to understand what category best describes the mobile concept'
FN	41	"The quantified potential adoption for this specific concept was 63.43%. This means that the mobile service concept fitted to the category 'high intention to adopt', which was represented by a bright green bubble. This made it easier for the team to understand the potential adoption".
P9	42	"it would make sure that some questions were not left out … sometimes in informal discussions, you could end up taking things for grand or you could end up not asking the right questions or even assume something and it might not actually be further developed or expanded upon. If you have a list of questions, of a checklist, at least you are ensuring that those questions get answered".
P7	43	"…I ended up finding out more about the context of the app…and thinking about the user group. I thought that it's best to think of this at a later date when we have the user base ready … but actually I think that it is better to consider these questions now".
P8	44	''It goes from having a vague idea and running with it to forcing people to think about factors we wouldn't have thought about''.
P9	45	"… It is valuable… for example, I was working on a project recently and it was only when I was testing it that I realised that this is a little bit cumbersome for users if they are going to be using it and I had to go back… not quite to the drawing board, but I had to go back and reconsider how to change that aspect that I was working on… but had that been asked earlier on I may not have spent the day working on this".
P9	46	"It would be useful for keeping the applications simple, for example not making them too complex. We don't want overly complex user interactions, so this would be very applicable for this"
P7	47	''It helped to refine the mobile concept and the way we viewed it, originally it was very broad and now it is more refined. For example, it helps you decide on your user group … should I be targeting older generations who have the stories to share or younger generations such as students… it helps you understand the users more''.
P9	48	"At the beginning of the process, if you have a common understanding and a common language, it makes discussing the service as you move further down the line easier, as you know that you are both talking about the same thing".
P7	49	"… It makes you feel more comfortable knowing you have covered a lot of aspects and you're not forgetting something that you would in the informal meetings…".
P8	50	"Using this tool can provide clarity, about what direction to go in".
P7	51	''We usually get stuck, when defining the mobile concept, which means we can go off on tangents and then the initial idea becomes a number of different ideas from different perspectives, whereas when you have structured questions, like this it keeps you on point. We didn't jump off topic and it's nice to have something like this to refer back to … this was the main thing for me''.
P9	52	"it would make sure that some questions were not left out … sometimes in informal discussions you could end up taking things for granted or you could end up not asking the right questions or even assume something and it might not actually be further developed or expanded upon. If you have a list of questions or a checklist at least … you are ensuring that those questions get answered opposed to an informal discussion where some questions may not get answered".
T	53	During the workshop the team reads the questions out loud and discussed each point in detail. The discussion began with one member suggesting their opinion, this continued until each member of the group had done so. The team then debated which score to allocate to each question". 'The team allocated scores to the specific characteristics which define the mobile concept and its context of use, and calculated a potential adoption score'.
FN	54	'Based on the scores allocated to each question the tool calculated the potential user adoption automatically, this was visually represented in a bubble chart'.
FN	55	'They accepted the mobile service was more defined due to the information generated from using of the assessment instrument (e.g. questions and categories). They also implied that this information may not have come up until far later in the project. For example, at the end of the workshop they suggested that they may now reconsider their target users (e.g. Students)'.
P9	56	"I think that it would be a nice tool to include in our process…it is fit for purpose when creating mobile applications".
P7	57	"I found it clear, it was well explained, all of the sentences were short and snappy as sometimes if you use a

		lot of terminology it's easy to lose people. I thought it was good, it was straightforward".
P9	58	" … You're assigning scores and putting them into the tool… it's like a spreadsheet exercise so it's very straight forward and easy".
P9	59	"It's valuable, even just to get the basics right…for example, I was working in a project recently and it was only when I was testing it that I realised that this is a little bit cumbersome for users if they are going to be using it and I had to go back... and reconsider how to change that aspect I was working on".
P7	60	"Going through the questions as a group means that the designers or the creative people have to think of the concept in reality… and that way you don't waste too much time on ideas that may not work".
P9	61	" … I know this from experience with projects… in early testing, these are things that come up… whereas by asking them early on in the project, it reduces the workload as you don't end up going down a blind alley trying to implement something that the clients eventually want to adjust and we could have established it earlier. It could cut a few problems off the path".
P9	62	"Often you will see these problems when you implement and start testing, whereas… when you go through a checklist earlier like we did today, we may not have to use as many resources later on in development".
P7	63	"It was really useful… I thought that it's best to think of this at a later date… but I actually think it is better to consider these questions now, we might not have an answer for them yet, but it gets us to consider the concept more and what we need to research before we start to design".
P9	64	"It is certainly useful, for example, as I mentioned earlier, it will help to cut problems off the path as we move further down the line as there are a lot of problems that only show when you have moved into the later stages of development…".
P7	65	"Once you're past the initial brainstorming' this is useful to keep you on track".
P7	66	''It was really useful in the sense that it structured my way of thinking…I found out more about the concept and its context''
P7	67	''It is appropriate as you need to be constantly thinking about the users from the beginning… at this stage it is ideal as it flags things that should be reconsidered and that we probably would not have thought about until we were in the design''.
P8	68	''Yes, again, I feel it draws people's attention to factors that otherwise would not have been considered''.
P7	69	"Well, there are things that we would be considering, but not in such a structured way. It was really good to have the questions laid out with the scales providing categories and examples… it helped to understand what category best describes the mobile concept".
P8	70	"Using it will give people clarity … so instead of just having a vague idea and running with that… using this tool they can provide clarity in their mind about what direction they want to go in".

Appendix L: CS3 Summary of Quotes from the Transcripts

		CASE STUDY THREE
S	**L**	Quote
FN	19	'The participants were observed discussing each question in detail and then selecting the type of service, and the categories which best describe their mobile concept. Following this they calculated a potential adoption score'.
FN	20	'The participants read the questions together as a team, and allocated a score to each question on a scale ranging from 0-100%'. Following this, the assessment instrument automatically calculated the potential user adoption score (84%), which was visualised in a 3D bubble-graph'.
FN	21	'After calculating and reviewing the adoption score the participants felt they were making the right decisions in terms of their mobile concept'.
P11	22	''I think that the tool works fast and I think that after it is used once or twice people would get used to the questions, and they could answer them quickly''.
P10	23	"… Yes, it is a very straight forward exercise."
P10	24	''I believe that it could be a valuable tool, I do see why you created this, it is important to consider these questions…I think perhaps in other organisations it would be beneficial''.
P11	25	''It does provide structure and that is the biggest selling point for me. The question topics make sure that all of the avenues are explored when innovating. However, given the applications that we create, it may not be applicable to us, but for other organisations having those questions would be useful''.
P10	26	"… Yes, you can see this is a structured way of checking to see if the concept may be adopted".
P11	27	"I think that it is appropriate and I think that all of the questions as you go through them are things that we would ask ourselves, so I think that it is all valid. It's just we would have a slightly different approach to how things are done".
P11	28	''I think that it is useful to go through the questions, we would normally ask ourselves very specific questions… so having a tool which guides you through those questions is definitely useful''.
P11	29	"… It may trigger some questions that people may not have considered, particularly if we are doing different types of applications and others are involved".
P10	30	"I think that perhaps in other organisations that are not asking those questions that are included in your assessment instrument… I think that it would be beneficial for them; however for us we are already doing this in a structured way. I think that maybe it is because we have a long track record of developing services and the managers here would tend to be highly experienced".
P10	31	''I don't believe that it would add anything to what we have already… because we have a very well-structured process in place, as we need to ensure that the service is safe for our users. Also, we cannot necessarily adjust or change the scores (e.g. description of the service) as the service itself is shaped by legislation''.
P11	32	''… We would have a different approach to how things are done. We build 99% of the time, because of legislation, so it is expected that people will use them''.
P11	33	''I think that generally people will ask questions if they didn't understand and even if you felt that someone missed your point or didn't understand, people would clarify for them. I think that we do a very good job already with communicating our point here to each other''.
P10	34	''I think perhaps for other organisations that are not asking those questions, it would be beneficial for them… however we are already doing this in a structured way. I think that maybe it is because we have a long track record of developing services and the manager here would tend to be highly experienced''.
P10	35	"I think that a lot of the questions that were in the assessment instrument we are already using, … we don't score them like you have to in the assessment instrument but we would consider all of the factors that are included in it… we are already asking these questions".
P11	36	"It's down to the questions and the way we ask them. When it's asked in a formal way, it's now in your head and you know that it is important to consider these further".
P10	37	"Some of the questions are obvious for our organisation, for example the quality of the information and security of the service. These would be one of the first things we specify, as security is very important to us, as it is necessary for us to provide secure services to the public".

P10	38	"The terminology that we use is consistent… I didn't think that the assessment instrument changed that".
P10	39	"We are very careful in this process and dedicate a lot of time to the concept, as if we didn't consider elements such as those included in your assessment instrument… like security, the reputation damage would be done. There would be articles in newspapers and on the radio… so maybe we must be more thorough than private companies have to be".
P10	40	"… The services have to be user friendly and easy to use… we want the public, our customers to use our services and one of the reasons that we have made mobile versions is so that it is convenient and available for them".
P11	41	"There is a series of evaluations that we would make… for example, the user experience is very important, we are aware that the public or the 'users' of our service are diverse and therefore we try to cater for all … we aim to ensure that information used is effective… that the flow of the service is intuitive".
P10	42	"Prior to 'signing- off' on the concept we would consider important things such as the user experience of the service…this would be one of the first things we would consider… it must then be examined by the departments' legal advisors who may make some suggestions…following that we would then develop wireframe screens to illustrate the overall concept and this would then also be reviewed to ensure that it is consistent with existing services".
P10	43	"We would review those as a group with management here in the business side and then once we get an agreement on that we would then go and start to design and develop the mobile application".
P10	44	"… We have a very well structured and grounded process in place as we need to ensure that the service is effective and safe for our users".
P10	45	"I think that perhaps in other organisations that are not asking those questions that are included in your assessment instrument… I think that it would be beneficial for them… however we are already doing this is a structured way".
P10	46	"Some questions we would already have the answers to, we don't have to think as we are restricted by legislation, for example sharing of public information, these are things we don't even have to think about because it's something we don't do".
FN	47	'After reviewing the adoption score, the participants felt that they were making the right decisions in terms of the mobile concept. They had a mutual understanding of the mobile concept. They agreed this information was important, but they felt that they would have considered this already, via their requirements gathering, wire-framing and UX assessments'.
P10	48	"To date I think that we have been quite successful as there is a high-uptake of our online and mobile services".
P11	49	"We build 99% of the time, because of legislation, so it is expected that people will use them".
P10	50	"… As our environment means we build these services, 99% of the time… due to direction of legislation, investing resources into the assessment instrument would not be needed as the public are expected to use the services".