DIGITAL SERVICE PROBLEMS:
PREVENTION AND USER PERSISTENCE IN SOLVING THEM

BY

ALIREZA NILI

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General Abstract

The service sector is an important and consistently growing sector of the world economy. It is estimated that the sector will make up two thirds of the total world Gross Domestic Product (GDP). Information Technology (IT) has been an important contributor to the fast and high grow of the sector by increasingly digitising the production, delivery and use of services. IT has enabled multiple parties, including user support service staff, employees (internal IT users) and customers (external IT users) of an organisation, to engage in the production, delivery and use of digital services. Consequently, both users and user support service staff of the organisations have an increased responsibility to both prevent IT problems from occurring, and solve them when they do occur. Problems with ITs can occur at different stages of a digital service value chain (i.e. sequential steps/stages required to produce and deliver a digital service), and may lead to a service failure in the user's mind. Examples include problems with a self-check-out machine at a library, problems with an online registration system that occurs for university students, or a website that does not include an online payment functionality a user expects. Numerous studies in both Information Systems (IS) and service literature have focused on the role of the service staff in both preventing and solving digital service failures, but few have considered the user's role in these.

This thesis includes four original articles. The first article emphasises that prevention from digital service failures must be considered before establishing effective approaches to solving the problems. The article presents a typology of technologies and technological approaches that customers and businesses can use to support prevention from these failures. The rest of the articles consider situations where an IT-related service problem has occurred, and address the user's behaviour of persistence in solving their own IT problem. From the user's perspective, their persistence in solving the problem contributes to achieving a satisfactory outcome, and from the organisational perspective, such an outcome is important for maintaining their user satisfaction. User persistence is important both when trying to solve an IT problem alone, and when using support services. Studying user persistence can help organisations to design their user support services in a way that encourages user persistence, resolves the problems more efficiently and cheaply; and maintains their user satisfaction. The study of user persistence included the use of focus groups for data collection purposes. Surprisingly, qualitative methodology literature has little

to say on analytical approaches to focus group data – particularly interactive participant data. Therefore, a focus group analysis framework was designed (presented in the second article) and was used in the analysis phase of the user persistence study. The third article uses the framework in its analysis phase, and (a) presents a conceptual clarification of user persistence in IT problem solving, (b) identifies the factors that contribute to user persistence, (c) develops a theory to explain that why a user decides to persist with a method of solving IT problems, and (d) develops a theory to explain that why the user decides to persist with the overall process (collective methods) of solving the problem. The fourth article presents the results of evaluating the robustness of the two theories and shows that the two theories are confirmed. The thesis concludes with the 'contributions and conclusion' chapter where it presents a summary of the contributions of the four articles to IS theory, methodology and practice.

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The Original Articles

Article 1:

Nili, A., Tate, M., & Gable, G. G. (2014). A Typology of Technological Enablers of Website Service Failure Prevention. *Pacific Asia Conference on Information Systems*, 24th -28th June, 2014, Paper-78.

Abstract: Businesses are increasingly employing technological solutions for error detection and service failure prevention; however, problems with digital services still occur at times, even for the best service providers due to the technical failures, informational failures or lack of required website functionalities. Considering the significant effects of digital service failures on customers' overall service quality perception and customer satisfaction, preventing service failure, and delivering reliable, robust digital services is a critical business competency. This paper focuses on preventing failures/problems with e-commerce websites. We first develop a digital service value chain framework for e-commerce websites based on existing service delivery models adapted for digital services. We then review current literature on service failure prevention, and provide a typology of technologies and approaches that can be used to prevent failures of different types that can occur at different stages in the service value chain. This makes a contribution to theory by relating specific technologies and technological approaches to the point in the value chain framework where they will have maximum impact.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

Article 2:

Nili, A., Tate, M., & Johnstone, D. (2015). A Framework and Approach for Analysis of Focus Group Data in Information Systems Research. *Communications of the Association for Information Systems* (an 'A' journal[1]). Accepted for Publication.

Abstract: A significant part of information systems research aims to study people as a part of a system, organisation, network or community. Since this research focuses on data related to the

[1] Journal ranks are based on The Australian Council of Professors and Heads of Information Systems (ACPHIS) ranking system. See http://www.acphis.org.au/

interaction of individuals, focus groups can provide data that cannot be obtained through any other method. This emphasises the importance of having a clear and systematic *analysis* framework for focus group data. However, compared with the abundance of handbooks and guidelines on how to *plan* and *conduct* focus groups, little methodological literature is available on how to *analyse* focus group data. In this paper we provide a systematic and integrative approach for qualitative analysis of different types of focus group data (e.g. group level content and interaction data) for Information Systems (IS) researchers. While we focus on IS research, our framework is also relevant to other applied business disciplines.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

An abridged version of this article was published at Australasian Conference on Information systems (ACIS) 2014:

> Nili, A., Tate, M., Johnstone, D., & Gable, G. (2014). A Framework for Qualitative Analysis of Focus Group Data in Information Systems. *Australasian Conference on Information Systems*, 8th - 10th December, 2014.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

Article 3:

> Nili, A., Tate, M., Johnstone, D., & Gable, G. G. (2016). User Persistence in Solving Their Own IT Problems. To be submitted to *MIS Quarterly*. (an 'A*' journal)

Abstract: Information Technology (IT) is increasingly essential in daily life, and people depend on IT products and services to accomplish a wide range of daily tasks. Inevitably, problems with using IT do occur, due to technical reasons, service staff mistakes, or the users' own errors or misunderstanding. From the user's perspective, there is often little specific guidance in relation to the IT problem and no obvious way to solve it. The process of solving the problem may extend over a considerable period of time and may include multiple means of problem recovery, including the user's own efforts, contacting user support staff and asking for help from other users. The trend

by organizations to increasingly limit direct interaction with customer service staff; rather providing more self-help information for the users (to reduce costs and manage problem resolution more efficiently); emphasises the increasing importance of user persistence in solving their IT problems. In response to Benbasat and Barki's (2007, p. 215) call for an expanded behavioural view of "what users do in and around the notion of system use" (i.e. user's IS use-related behaviours), to date, all IS studies in this area which have an individual-level post-adoptive behavioural view have considered user's behaviours in one of the two situations, including (1) where there is an IT event/interruption which is either implementation/installation of a new IT or a significant change made to an existing IT by an organisation (e.g. the studies of user coping and adaptation), or (2) in a normal situation where no IT interruption has happened yet (e.g. the studies of habitualised use of IT). Because IT problems inevitably occur for users following the implementation of an IT and users play an important role in solving them, this paper suggests that IT problems should be considered as an IT event (an IT interruption) as well and considers solving such problems as an IT post-adoptive behaviour. The study examines the notion of user persistence in the context of user IT problem solving and in the domain of individual-level IT post-adoptive behaviours. The paper makes three contributions: a conceptual clarification of user persistence in IT problem solving; identification of factors that contribute to user persistence in solving their own IT problem; and the development of two theories of persistence using a grounded approach.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

An abridged version of this article was presented at JAIS Theory Workshop, Singapore, 2015:

> Nili, A., Tate, M., Johnstone, D., & Gable, G. (2015). When Problems Happen: Towards A Theory of User Persistence in Solving Their Own IT Problem, *JAIS Theory Workshop*, Singapore, July 2015.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

Article 4:

Nili, A., Tate, M., Johnstone, D., & Gable, G. G. (2016). Testing the Theory of Method Persistence and the Theory of Process Persistence. To be submitted to *Behaviour and Information Technology* (an 'A' journal).

Abstract: Information Technology (IT) problems frequently occur in real-life situations such as in work, education and businesses. From the user's (or consumer's) perspective, their persistence in solving the problem contributes to achieving a satisfactory outcome, and from the organisational perspective, such an outcome is important for maintaining their customer satisfaction and retaining their customers. In our previous work, we distinguished between user persistence with a specific method of solving IT problems and user persistence with the overall process (collective methods) of solving an IT problem, and developed the Theory of Method Persistence (TMP) and the Theory of Process Persistence (TPP). In this study, we used the diary and individual interviews methods in tandem to test our two theories. The results of our data analysis confirmed both TMP and TPP. A discussion of the findings, an explanation of the research limitations and our suggestions for future research are also presented.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

An abridged version of this article was published at Australasian Conference on Information systems (ACIS) 2014:

Nili, A., Tate, M., Johnstone, D., & Gable, G. (2014). Consumer's Persistence in Solving Their Own Problem with Self-Service Technology. *Australasian Conference on Information Systems*, 8th - 10th December, 2014.

As the first author, Alireza Nili has taken the lead in writing this article with editing done by the co-authors.

Chapter 1

1. INTRODUCTION

1.1 MOTIVATION

The service sector is an important and increasingly large sector of the world economy. Over one third of the global workforce work in various service industries such as computer services, education, government, transportation and finance (The Economist, 2013; World Bank, 2014). The sector is consistently growing and is estimated to make up two thirds of the total world Gross Domestic Product (GDP) (Referenceforbusiness.com, 2015; World Bank, 2014). For example, New Zealand's service sector, which makes up two thirds of the country's economy, has been growing by 2.6 per cent on an annual basis (nzherald.co.nz, 2014). Information technology (IT) has been a significant contributor to this growth by increasingly digitising the production, delivery and use of services in various service industries. Examples include the use of IT in distance education, online purchase of items, mobile banking, and online tax registration. The digitised nature of services has enabled multiple parties, including user support service staff, employees (internal IT users), and customers (external IT users) of an organisation to engage in the production, delivery and use of a digital service (Alter, 2008; Kasabov, 2010).

This also means that both users[2] and user support service staff of the organisations have an increased responsibility to prevent IT problems from occurring and in solving them when they occur. Problems with ITs can occur at different stages of a digital service value chain[3], and may lead to a service failure/problem *in the user's mind* (a service failure is defined as the gap that occurs when a customer's perceived quality of service delivery does not match their service expectations; Lin, Wang and Chang, 2011; Sabharwal and Soch, 2011). Examples include problems with a learning management system that occurs for a university teacher or a school administrator, and problems with an online application system that occurs for university students, or an e-commerce website that does not include the functionality a user expects (for example, it

[2] The thesis considers a 'user' to be the end-user of an IT. Except for the first article of the thesis which focuses on the external users (customers), the term user in this thesis is used for both internal users (employees) and external users (customers) of an organisation. This is also mentioned in section 1.2 (the scope of the thesis).

[3] A digital service value chain comprises sequential steps/stages required to produce and deliver a digital service (Alter, 2008). For example, in order to purchase an item online, a customer needs to follow the steps/stages of the service value chain of the website, including online information search, evaluation of options, making service request, online payment, etc. See section 2.1 and section 2.3 in Chapter 2 (Article 1) for the complete definition and more details on the concept.

does not have an express shipping service). We note that not all of these examples include technical failures or outages.

Numerous studies in both Information Systems and service literature have focused on the role of the service staff in both preventing (e.g. Chang, Kuo and Ramachandran, 2016; Chomsiri, 2007; Tyagi and Srinivasan, 2011) and solving digital service failures (e.g. Chen, 2013; Mostafa, Lages and Sääksjärvi, 2014), but few have considered the user's role in these. This thesis examines and unpacks aspects of the user's role at two points in a digital service failure experience – the 'front end' (failure prevention) and the 'back end' (failure resolution) in four original articles. The first article emphasises that prevention from digital service failures must be considered before establishing effective approaches to solving the problems. The article presents a typology of technologies and technological approaches that users and businesses can use to support prevention from these failures. The article considers the external users (customers) in the context of e-commerce websites. Various technological reasons may cause a service failure at each point of the service value chain of digital services that are produced via these websites. Identification of the technological reasons that may cause these digital service failures, and designing the typology based on this type of IT can be useful for preventing from the failures with many other digital services that are offered via other types of IT (see section 2.1 in the next chapter for a brief justification and discussion of this).

The rest of articles address a specific type of user behaviour when faced with a perceived IT problem – namely user persistence in solving their own IT problem. From the user's perspective, their persistence in solving the problem contributes to achieving a satisfactory outcome, and from the organisational perspective, such an outcome is important for maintaining their user satisfaction and the organisation's productivity. User persistence is important when the user employs any way of solving the problem. It is important both when trying to solve an IT problem alone, and when using support services. In addition, the trend of providing more self-help information such as online instructions for the users and increasingly limiting the direct user support options (to reduce costs and manage problems resolutions more efficiently; Forbes.com, 2014; Kasabov, 2010) shows the increasing importance of user persistence in solving their own IT problem. From the user's perspective, there is frequently no clear description for IT problems and no obvious way of solving

them. Therefore, often the process of solving an IT problem may be spread over a considerable period of time and may include at least two methods of solving the problem, such as solving the problem using one's own efforts, asking for help from user support service staff, or from other users.

Given the importance of studying user persistence behaviour, the purpose of this study is to (a) identify the factors that contribute to this persistence, (b) develop a theory that explains why a user decides to persist with a specific method for solving IT problems (method persistence), and (c) develop a theory that explains why the user decides to persist with the overall process of solving the problem (process persistence)[4]. The user persistence study is also a response to Benbasat and Barki's (2007, p. 215) call for an expanded behavioural view of "what users do in and around the notion of system use". The persistence study suggests that perceived IT problems should be considered as an IT interruption[5], examines the notion of user persistence in the context of user IT problem solving, considers solving such problems as an IT post-adoptive behaviour and presents its contributions to the IS studies in this area (e.g. to the studies of user coping and adaptation to an IT interruption which are explained in chapter 4). It also contributes to the psychology studies which aim to develop motivation-based process theories of problem solving. However, the overall thesis is still under the umbrella of service science in general (please see section 1.3).

In order to achieve these three objectives (identifying persistence factors and developing the two persistence theories), focus groups with users were conducted extensively. These included three focus groups with the three major groups of users, including teaching staff, students and administrators with a variety of backgrounds at a large New Zealand research university (see section 4.5.1 in chapter 4 for details). While the study was being conducted, it was noticed that there is little research on how to analyse focus group data, particularly for information systems researchers (Onwuegbuzie, Dickinson, Leech and Zoran, 2009; also, see section 3.1 for details). Therefore, a focus group analysis framework was designed and used in the analysis phase of the

[4] As it will be mentioned in chapter 4, these theories are named the Theory of Method Persistence (TMP) and the Theory of Process Persistence (TPP).

[5] As it will be explained the Chapter 4, to date, all IS studies in this area which have an individual-level post-adoptive behavioural view have considered user's behaviours in one of two situations, including (1) where there is an IT event/interruption which is either implementation of a new IT or a significant change made to an existing IT by an organisation (e.g. the studies of user coping and adaptation), or (2) in a normal situation where no IT interruption has happened yet (e.g. the studies of habitualised use of IT).

user persistence study. The findings can help businesses to design their user support services in a way that encourages user persistence, resolves the problems more efficiently and cheaply, and maintains their user satisfaction.

1.2 THE SCOPE OF THIS THESIS

Both parts of the thesis (including the digital service failure prevention and the user persistence studies) are under the umbrella of service science (a study of systems in which specific people and technologies take actions to provide value for others; Alter 2008) in general, and are within the context of digital services and digital service failure[6]. The thesis considers a 'user' to be the end-user of an IT. The failure prevention part considers customers (external users). The user persistence part extends this to both employees (internal users) and customers (external users) of an organisation. Both parts of the thesis consider ITs for which user support service is available. However, the first part considers e-commerce websites and the second part considers work and study related types of IT. The advantages of considering e-commerce websites for the service failure prevention study was briefly explained in the previous section and also will be explained in section 2.1 in the next chapter. In relation to the user persistence study, work and study related IT applications allow gathering data about a wide range of IT problems that frequently occur for users in real life situations. Moreover, this application domain allows gathering data about a range of IT problem-solving methods that a user may employ to solve a problem. The rest of this section provides more information on choosing this type of IT, participants/users of this IT, the environment and the situations in which data was collected, etc. for the user persistence study.

The findings of the service failure prevention study are the result of a comprehensive review of digital service failure studies in the information systems, e-commerce, and service management domains. In contrast, the findings of the user persistence study are mainly based on empirical research, where participants are the teaching staff, students and school administrators at Victoria University of Wellington (VUW). VUW is a large New Zealand university with students and staff from a diverse range of backgrounds. This includes a large population of domestic and international students (21,000 students, including over 2,800 international students from 80

[6] More details about the area and domain of the thesis are presented in the section 1.3: chronology and positioning.

countries) and staff with various fields of study and levels of experience. VUW was recognised as the New Zealand's top ranked university for research quality in 2012 (2012 Performance-Based Research Fund). The University offers a range of service supported work and study related ITs (e.g. learning management system, library systems, audio and video recording systems and for teaching staff, students and school administrators, and various other work and study related ITs), and the users at the university can use their own work and study related devices such as laptops, tablets, smartphones, and software and applications for many of which service support is available. Moreover I have been both studying and working at VUW and have been familiar with the organisation and its IT resources, and had easy access to the three groups of IT users. This research considered both the ITs available at the university and the user's own devices. This means that the technologies used would be important to users and they would be likely to show a good range of levels of persistence in resolving problems. Also, the selection of participants at VUW means that participants have a medium to high level of education, and are likely to have fewer restrictions to employing a range of IT problem solving methods. Although limiting this study to these types of participants will limit generalisability, it has the advantage of enabling me to gather as many persistence factors as possible.

Participants were asked to provide information on their persistence behaviours in situations where they would not feel anxious about their actions being observed. This would exclude, for example, their persistence in solving occasional problems with presentation related ITs while presenting a seminar or a course. In this way the study was able to identify as many persistence factors as possible. The study does not limit its scope to any amount of time spent persisting, or to any level of perceived effort in persistence (e.g., a low, medium or high level of persistence). Persistence in solving an IT problem starts right after the point of time at which a user identifies the problem (i.e., right after the "first click") and may last until any point of time at which the user achieves what they consider to be a satisfactory outcome (a satisficing result – which may be different to the solution they originally envisaged) or gives up solving the problem altogether.

Figure 1.1 illustrates a brief overview of the periods of time the overall thesis has considered. As shown in the figure, the thesis considers users at two points in a digital service problem– the front

end (problem prevention) and the back end (problem resolution: user persistence in solving the problem).

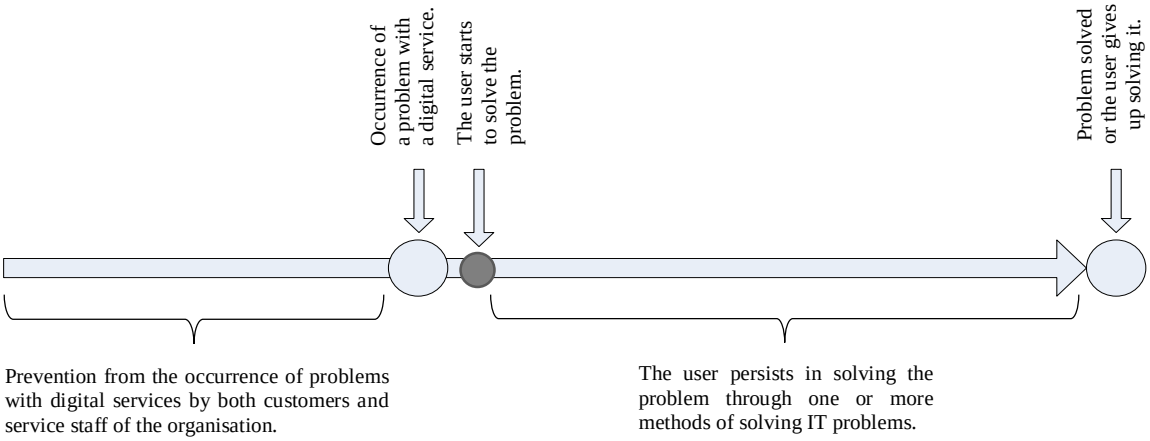

Figure 1.1: The Periods of Time Considered in the Thesis

1.3 CHRONOLOGY AND POSITIONING

A 'thesis by papers' makes the journey and development of thinking more visible than a traditional thesis, and my thinking did evolve somewhat during this journey. Figure 1.2 illustrates this evolution of thinking and that how it resulted in the current chronology of the articles and formed the current/final thesis. As shown in the figure, work on the thesis started with an interest in e-commerce and service quality in the context of self-service technology (SST). Preliminary literature review in this area led to recognition of the important role of the user in creating their own service experience in the bigger context of 'digital services' in both service problem prevention and service problem recovery. I started working on e-commerce website service problem prevention by focusing on preventing IT problems since IT problems can cause perceived digital service problems, and because problem prevention should be considered in the first place (see the previous section for the explanation of this). The findings of this problem prevention study was published and is presented as Article 1 in the thesis.

Following Article 1 and as a result of an extensive literature review in the area of service problem recovery, I identified user persistence as an important and understudied phenomenon in problem recovery. After an extensive literature review, examining a very large number of theories in IS,

service management and psychology and examining their explanatory power for user persistence, I realised that the topic is novel and that no existing theory or framework fits well. Therefore, I conducted a grounded study, reconceptualising its findings, and positioning the emergent theory back into the literature. While doing the study and when deciding to collect primary data from users, I realised that the Critical Incident Technique (see the methodology section: section 1.5) can be best applied through the focus group method, but no published frameworks that are clear and systematic enough for the analysis of focus groups could be found. Therefore, I started developing a framework for qualitative analysis of focus group data in information systems. The designated analysis framework is presented as Article 2 in the thesis.

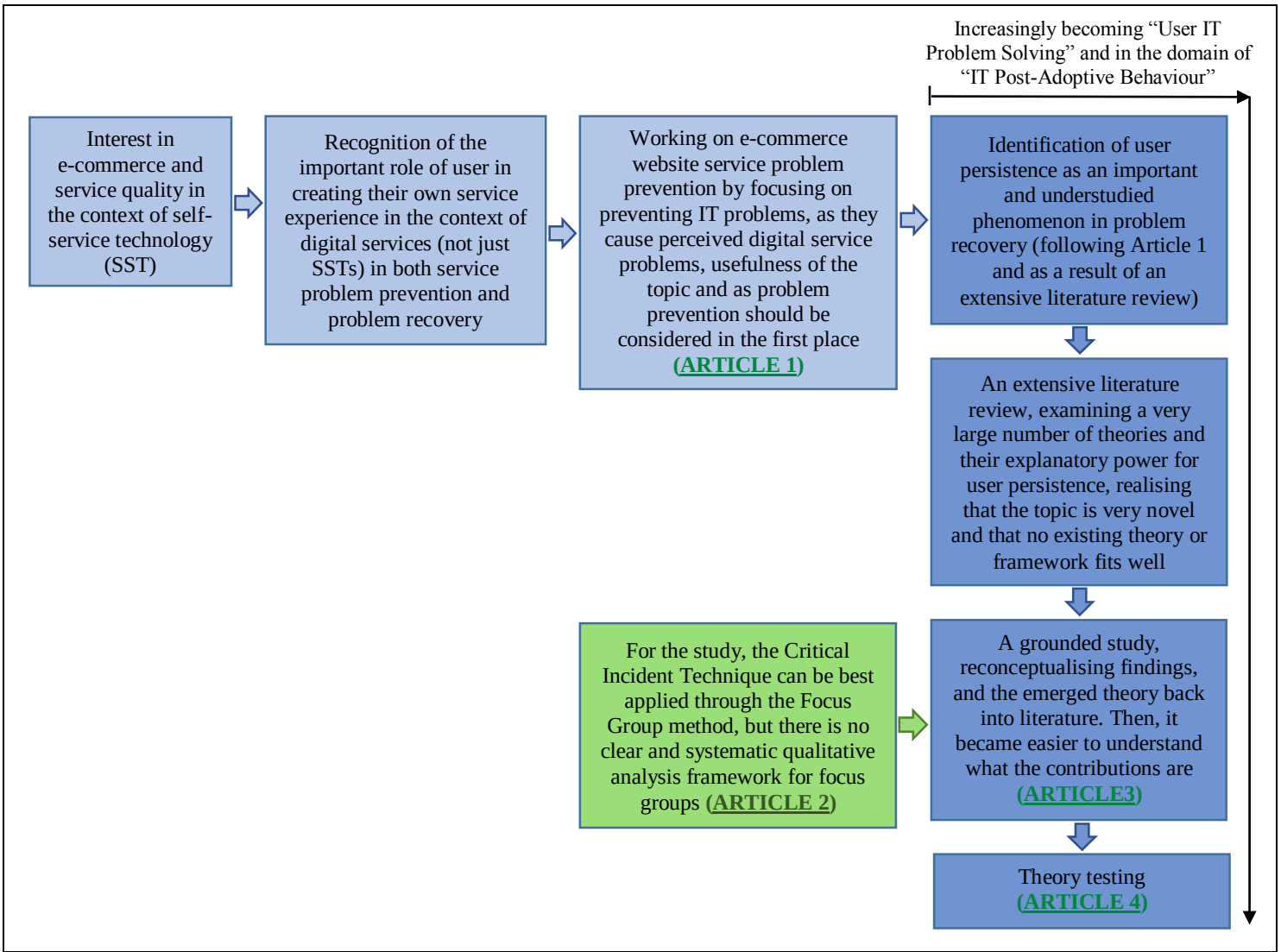

Figure 1.2: Chronology and Positioning

The framework was then used for the data analysis part of user persistence, which ended with two theories of user persistence emerging. At this point, it became easier to more precisely position the study and to understand what the contributions to theory and practice are (this was not quit clear at the beginning and in the middle of this grounded study). As shown in the figure, it became completely clear that Article 3 is a "user IT problem solving" study and its contributions are mostly for IS research in the domain of "IT post-adoptive behaviour", such as research on the process of user coping and adaptation to an IT event and research on user learning and enhanced use of IT (these are explained in the literature review and contribution section of the article). However, as mentioned, the user persistence study (and the overall thesis) is still in the broad area of service science. The findings also have implications for the studies of problem solving in psychology research, since all problem solving theories relevant to the notion of persistence were also reviewed as a part of the literature review, and the article presents information on how the two emergent persistence theories can contribute to developing new motivation-based and process-oriented theories of problem solving. Finally, the robustness of the two persistence theories were tested quantitatively. Article 4 presents the results of this test. It also shows that the two theories are supported.

1.4 RESEARCH QUESTIONS

This thesis addresses the increasingly important area of responding to IT problems and failures, including approaches for preventing digital service failures, and for encouraging users to persist with solving their own IT problems. The research questions are:

1. What are the technology related reasons for digital service failures?
2. What are the technologies and technological approaches to support the prevention of digital service failures?
3. What are the factors that contribute to user persistence in solving their own IT problem?
4. In the event of an IT problem for a user and when the user starts to solve the problem,
   4.1 Why does the user decide to persist with a method of solving IT problems?
   4.2 Why does the user decide to persist with the overall process (the collective methods) of solving the problem?

1.5 RESEARCH METHODOLOGY[7]

In order to design the typology in the digital service failure prevention study, a comprehensive review of digital service failure studies was conducted in IS, e-commerce, and service management domains. Experts in the field were also asked to provide their opinion on the typology, and to revise it. After designing the typology, the user persistence study part of the thesis began. The focus of the study is on the user of digital services. However, several digital service problems may occur for each user; therefore, the event of a perceived digital service problem is the unit of analysis in the user persistence study. The study followed the post-positivist paradigm. Positivist paradigm assumes that there is a single truth about a research phenomenon out there that the researcher strives to discover and then test it through considering a clear set of objective assumptions about the world and quantitative methods to testing researchers' hypotheses. Unlike the positivist paradigm, the post-positivist paradigm assumes that there is a single truth, but that our knowledge of it will always be imperfect – because, for example, individuals socially construct their view of it. The post-positivist paradigm is highly aligned with qualitative methods in social sciences and is open to interpretation about subjective humans (Annells, 1996; Guba and Lincoln, 1994)[8]. The post-positivist paradigm admits participants' reported experiences (e.g., the event of an IT problem and how it was managed), their own behaviours (e.g., their persistence in solving the problem), and the researcher's logic in supporting theory generation. The paradigm is aligned with the Grounded Theory method (Annells, 1996), which was used in the user persistence study.

In information systems research, there are four approaches to theorising, including (1) the "grounded theory building" approach to build a theory inductively, grounded in empirical data and based on patterns of events or behaviours; (2) "[an inductive] bottom-up conceptual analysis to identify different sets of predictors relevant to the phenomenon of interest using a predefined framework"; (3) "[a deductive approach] to extend or modify existing theories to explain a new context, such as by extending theories of individual learning to explain organizational learning";

[7] This section only presents a summary - a high-level view - of the research methods which were used in the thesis. See the methodology section of each article for detailed discussions on our choice of the related methods and for detailed description and explanation of each method.

[8] Guba and Lincoln (1994) suggest that there are four basic paradigms including positivism, post-positivism, critical theory and constructivism. The fourth paradigm has also been called constructivist-interpretive (Denzin and Lincoln, 1994). However, authors such as Schwandt (1994) consider interpretivist as a separate paradigm. As explained, this thesis follows the post-positivism paradigm because of its suitability for the purpose of the thesis.

(4) “to apply existing theories in entirely new contexts by drawing upon the structural similarities between the two contexts” (Bhattacherjee, 2012, p. 29). The grounded theory method was chosen for the user persistence study, since none of the existing theories and frameworks fits well to the topic of this paper and none of them can fully explain the user persistence phenomenon.

In order to identify the persistence factors and develop the two persistence theories, the steps of the grounded theory method suggested by Strauss and Corbin (1990, 1998) were followed. However, user behaviour and decision making have been widely studied (though not specifically on the topic of this research) in both the information systems and psychology literatures. Therefore, it was clear that a number of persistence factors could be identified from the literature, or at least, the literature could help to efficiently name/label the factors which were identified in the first step of the primary data analysis (Bhattacherjee, 2012, p. 114). Therefore, a list of candidate persistence factors was developed and used in the initial coding step of data analysis. This approach is similar to the template coding idea suggested by King (1998) which has been used in tandem with a grounded theory approach by several theory building papers such as Maznevski and Chudoba (2000), Faraj, Kwon and Watts (2004), Tanudidjaja, Kankanhalli and Tan (2003) and Vaidya and Seetharaman (2011). While the identified template codes served as an initial set of categories, during the data analysis, we remained open to changes in the coding structure. For example, it was clear that some of the candidate factors in the list might need to be relabelled, or further decomposed into sub-categories, some might not be supported by data, and new persistence factors might emerge.

The Critical Incident Technique (Flanagan, 1954) was used in the initial coding of the primary data. It is a popular technique in health research, marketing and organisational behaviour studies, and is used for the purpose of identifying very effective and very ineffective contributing factors to a result, such as a service failure. In this research, the technique was used through three focus groups with users to identify the persistence factors, and to develop the two persistence theories. However, it was noticed that there is little research on how to analyse focus group data, particularly for the studies of user behaviour in information systems research. Therefore, a focus group analysis framework was designed and was used in the analysis phase of the study, resulting in identification of persistence factors and developing the two persistence theories.

After developing the two theories, new data was collected through diaries and semi-structured interviews to evaluate the theories. The diary and individual interview data were obtained from different participants (i.e., not the ones who had participated in the focus groups), providing triangulation and validation of the emerging results with a new set of respondents. Using the diary method, each user self-reported his or her own decisions, while trying to solve his or her own IT problem, in a diary format file. The data obtained from a participant's diary provided the platform for the interview with that participant. The individual interview protocol comprised two main parts: first, a set of questions to gather qualitative data, and then a set of questions to gather quantitative data. Both parts of each individual interview were conducted in the same session of the interview. The findings of the qualitative part were compared with the findings from the earlier focus group data analysis. The purpose of this was to ensure the consistency and completeness of the persistence factors and the relationships between them (i.e., the building blocks of the two persistence theories). The quantitative part of the interview protocol consisted a questionnaire comprising a set of questions to examine these factors and their relationships quantitatively, and to empirically test the two theories. It started with a set of questions to test the Theory of Method Persistence (TMP), and continued with a second set of questions to test the Theory of Process Persistence (TPP) (the two theories which were developed in the third article). The questionnaire had been modified prior to each interview session based on the data that had been obtained from the participant's diary.

1.6 OUTLINE OF THE THESIS

The thesis includes six chapters. These include the introduction (chapter 1), four original articles each of which constitutes a chapter (chapters 2 to 5), and the contributions and conclusion (chapter 6) which presents a summary of the findings of the four articles and their contributions to theory, to methodology and to practice. Figure 1.3 presents the conceptual framework of this thesis. According to Miles and Huberman (1994), a conceptual framework outlines the primary elements of the study. The conceptual framework in this thesis places the four original articles into a bigger picture to explain how the articles constitute this thesis and which research questions (RQs) are addressed by each of the articles. In this figure, each box presents an article. The first box is related to the first part of the thesis (i.e. the first article: the problem prevention study) and the other three

boxes are in a dashed box representing the second part of the thesis (i.e. the second, the third and the fourth articles which cover the user persistence study). The arrows between the last three boxes show the sequence of the articles and how the findings of each article supports conducting the next study/article – showing the logical order of the articles (also, see the chronology section).

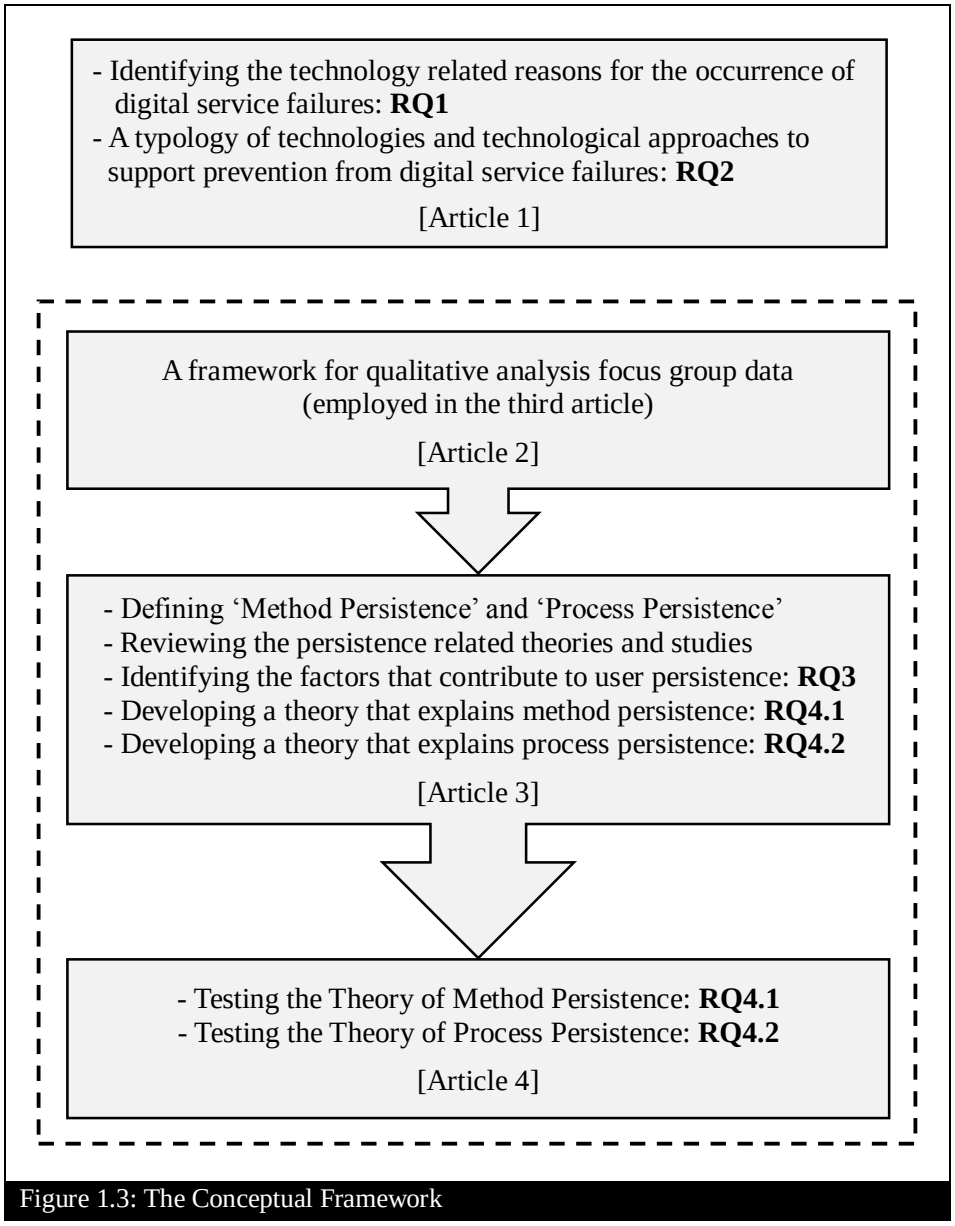

Figure 1.3: The Conceptual Framework

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Chapter 2

A TYPOLOGY OF TECHNOLOGICAL ENABLERS OF WEBSITE SERVICE FAILURE PREVENTION

Abstract: Businesses are increasingly employing technological solutions for error detection and service failure prevention; however, problems with digital services still occur at times, even for the best service providers due to the technical failures, informational failures or lack of required website functionalities. Considering the significant effects of digital service failures on customers' overall service quality perception and customer satisfaction, preventing service failure, and delivering reliable, robust digital services is a critical business competency. This paper focuses on preventing failures/problems with e-commerce websites. We first develop a digital service value chain framework for e-commerce websites based on existing service delivery models adapted for digital services. We then review current literature on service failure prevention, and develop a typology of technologies and approaches that can be used to prevent failures of different types that can occur at different stages in the service value chain. This makes a contribution to theory by relating specific technologies and technological approaches to the point in the value chain framework where they will have maximum impact.

Keywords: Service failure prevention, service value chain framework, typology, technological enablers.

2.1 INTRODUCTION

Services are an increasingly large and important sector of the world economy, and are estimated by the World Bank to make up approximately two thirds of the total world Gross Domestic Product (GDP) (World Bank, 2014). The nature of services and service delivery is also changing, becoming increasingly digitised, with an increasing emphasis on the user's role in self-service, service co-creation, and service recovery (Tate, Furtmueller, Gable and Gao, 2014; Tate and Evermann, 2009, 2010). For example, the New Zealand government has a goal that 70% of common transactions between citizens and government will be conducted online by 2017 (State Services Commission, 2014). The increasing volume and complexity of digital services and the inevitable occurrence of problems with them (due to technical reasons, service staff mistakes, or the customers' own errors

or misunderstanding) have led businesses to increasingly employ automated solutions for error detection and service failure prevention as well as for service failure recovery (Kasabov and Warlow, 2009; Kasabov, 2010). Considering the consequences of service failure and its effects on customers' overall service quality perception and customer satisfaction, preventing service failure, and delivering reliable, robust digital services are a critical business competency. In addition, the fact that digital services (e.g. services offered through e-commerce websites) are often co-produced by both service providers and customers[9], shows the increasing role of both service providers and customers in preventing digital service failures.

The concept of service failure is based in Expectation-Confirmation Theory (ECT) (Oliver, 1980), and is defined as the gap that occurs when a customer's perceived quality of service delivery does not match their service expectations (Lin, Wang and Chang, 2011; Sabharwal and Soch, 2011; Zhu, Nakata, Sivakumar and Grewal, 2013). This can be due to system error, staff error or the consumer's own mistakes (Casado-Dı´az and Nicolau-Gonza´lbez, 2009; Dabholkar and Spaid, 2012; Van Vaerenbergh, Larivière and Vermeir, 2012; Zhu et al., 2013). Since many service failures happen due to system errors, fast identification and correction of these errors (which sometimes can be done in seconds, or less, through dynamic and automatic error detection and recovery) can prevent them from becoming a real service failure in the minds of customers, since they are corrected before the customer is aware they have occurred. Due to the nature of some technical errors and the time needed to analyse them (e.g. through 'root cause analysis' or through analysis of failure related data stored in databases), some failures cannot be prevented at the time. However, technologies can enable service providers and customers to prevent similar service failures occurring in the future. Moreover, some technology enablers (e.g. online chat capabilities, social media, and online tutorials) can empower customers and service providers to communicate and interact in a way that can prevent, or at least minimise, the probability of service failures occurring.

In order to more appropriately manage digital service failure prevention, a deeper understanding is required of the nature and characteristics of digital service failure, and the technological enablers of service failure prevention that firms and customers can employ to avoid various digital service

[9] For example, a customer should follow a series of steps (e.g. information search, evaluation of options, entering some information, purchase activities, such as online payment) to purchase a product or produce and use a service via an e-commerce website.

failure types. This study contributes to the Information Systems (IS) literature and practice by developing a typology of the technological enablers (including both specific technologies and technological approaches) that can be used by both service providers and customers to prevent these failures. We focus on preventing failures/problems with digital services offered via e-commerce websites. The reasons for this choice are threefold. First, the service value-chain of e-commerce websites is well understood by most people, well-studied and can be adapted for failure prevention. A service value chain framework "presents a two-sided view of service processes based on the common observation that services are typically coproduced by service providers and customers" (Alter, 2008, p. 72). The service value chain of e-commerce websites includes several various steps/stages of digital service production and delivery, such as online information search, evaluation of options, making service request, online payment, etc. Second, various technological reasons may cause a digital service failure at each point of the service value chain of e-commerce websites. Third, perceived failure could occur from a customer perspective at any of these points without a real system outage (e.g. because of a customer's misunderstanding of the functionalities provided on the website, due to inaccurate information provided by the service provider). These three factors make it suitable for illustrating the range of failure types, and preventative technologies and strategies, in our study. We believe that the insights from this illustration are generalizable to many other types of digital services.

A typology is defined as "a classification according to general type"[10]. A typology is distinct from a taxonomy in that while a taxonomy develops increasingly fine levels of classification, where lower level nodes share all the properties of the higher level nodes (Marradi, 1990), a typology groups objects of a set into several subsets according to the perceived similarities in their states on one or more *properties* (Marradi, 1990). We use multiple *properties* for classifying enablers of digital service failure prevention, based on leading models from multiple disciplines. We classify prevention technologies according to the *type of failure* they are aimed at: system failure (sub-categorised into network and security failures); information failure; and functionality failure (recognising that one type of failure may lead to another). We also classify prevention technologies according to the *point in the service value chain*[11] at which they can be utilised. Finally, we classify

[10] http://www.oxforddictionaries.com/definition/english/typology
[11] We develop a new value chain framework for digital service delivery

prevention technologies according to whether they are *usable by customers or organisations*. These properties, in combination, provide rich and actionable insights for customers and website managers aiming to reduce failure and improve their service experience.

The rest of this paper is organised as follows. We first explain the process we went through to design and evaluate our typology in the next section. The section first presents an explanation for why and how we developed a digital service value chain framework for e-commerce websites, and how we used it in the design of our typology. It continues with presenting more details on how we designed the typology and ends with information on how we evaluated it. Next, after a comprehensive literature review, we identify different digital service failure types and technological enablers that can be used to prevent these failures. Finally, we present our typology by applying the technological enablers and service failure types to different stages of the service value chain framework based on the perspective of the customer and the service provider. This is followed by a discussion and a conclusion.

2.2 METHODS

Our goal was designing a typology that presents the technological enablers (both technologies and technological approaches) of website service failures according to the type of service failure they are aimed at (e.g. system failures and/or informational failures that may occur at a point in the digital service value chain).

As mentioned, digital (e.g. e-commerce website) services are typically co-produced by both service providers and customers; therefore, we classify these prevention enablers according to whether they are usable by customers or organisations. The typology can be useful for e-business and information systems academics and practitioners. References are also provided to enable readers to access more in-depth technical descriptions. The rest of this section explains that how we designed the typology. This starts from why and how we designed a digital service value chain framework and how we used it in the design of the typology, continues with how we designed the typology and ends with how we evaluated its robustness.

2.2.1 Design of the Digital Service Value Chain Framework

Designing our typology started with developing a digital service value chain framework for e-commerce websites. Designing a service value chain framework can provide richer insight into service failure by classifying the exact stage (of service production and delivery) at which a customer's expectation of the service is formed and the stage from which service failures may happen. Therefore, the framework can be used in designing our typology by being a criteria to organise the technological enablers (in the columns of the typology table) according to the type(s) of service failure they can prevent at a stage in the value chain.

In order to design the service value chain framework, we reviewed IS, e-commerce and service management literature, and identified the most important service value chain frameworks. However, each of them has some limitations. For example, some of them present a very general and oversimplified overview of service production and delivery steps, some do not consider the co-production nature of e-services, and some do not specifically address *website* service activities. Therefore, we felt that a new and more granular digital service value chain framework can be designed through combining the stages of the most relevant extant frameworks. The next section presents a brief overview of these frameworks and our designated digital service value chain framework for e-commerce websites (see Figure 2.1).

Cognisant of the co-produced nature of digital services, we show the customer's responsibilities in the service value chain, and the service provider's responsibilities in the service value chain. The steps carried out by e-commerce customers start from need/want recognition, and the corresponding step for service providers is creating awareness of the service, and the process may be abandoned before completion, but if it is completed, the process ends with post-purchase evaluations by both customers and service providers. Based on the definition of service failure (i.e. a service failure happens if customer's perception of service delivery falls below their prior expectation), our website service value chain framework shows that a customer's expectation of service delivery is formed in the "evaluation of options" phase, while the possibility that a service failure may occur from the "making service request" phase of the website service value chain

framework onward[12]. Therefore, our typology of technological enablers starts from the "making service request" phase.

2.2.2 Design and Evaluation of the Typology

We reviewed the extant information systems, e-commerce and service management literature, and identified the types of digital service problems. See Table 2.1 for the examples of service failures that may occur in each related phase of the website service value chain framework. We then reviewed the literature again to identify the technological enablers that can be used to prevent these service failures. Sources included journal articles, books and conference papers in Information Systems, e-Commerce, and Service Management fields within ProQuest Computing, ACM Digital Library, Web of Science, ScienceDirect, and SpringerLink databases and the AIS Electronic Library. In order to search for relevant papers within these databases, we used several keywords which included service failure; digital service failure; e-service failure; service problem; digital service problem; e-service problem; service recovery; e-service recovery, service failure prevention and service problem prevention. Among these, the papers in the area of traditional service contexts (the ones which only focus on face to face service interactions and/or do not consider the usage of interactive technology-mediated service interactions and delivery) were excluded. Then, the service problem recovery papers where their main focus is not on technologies and technological approaches of problem prevention were excluded. For example, the papers about problem recovery and complaint handling were excluded. Forward and backward citation checks were carried out for each of the remaining papers. This process sometimes led the search to identification of some papers which had been already found. This gave us confidence that we have achieved saturation.

Finally, after identification of service failure/problem types and technological enablers from the literature, we located and categorised the enablers based on whether they can be used by *service providers* (see Table 2.2) or by *customers* (Table 2.3) for each type of service problems that may

[12] We note that 'some' customers may have a certain amount of expectations already during the 'information search' step of the digital service value chain (showing the probability that informational failures may happen at this stage). However, all or most customers have some certain expectations at the 'evaluation of options' stage. This is also similar to considering significant and most relevant factors in developing IS theoretical models.

occur in each phase of the digital service value chain. As explained, the columns of the two tables start from the "making service request" phase of our service value chain framework.

We note that in typology development, the researcher only develops 'a' typology, not 'the' typology. There is no restriction on the range of properties that can be used for classification purposes, or their theoretical origins. However, it is necessary that the properties used for typology development are clear, consistent, intuitive and theoretically sound. Therefore, to validate the typology, our three tables (Table 2.1, Table 2.2 and Table 2.3) were work-shopped and validated with eight academic experts, including three from IS, three from e-commerce, and two from computer science, at a university in New Zealand. We first explained that the columns (i.e. customer's and service provider's roles starting from the "making service request" stage) of our service value chain framework present the criteria for the typology. Next, we asked participants to add, remove or revise any column of each table. Also, we asked them to add, remove and/or revise the contents of each column. The only changes include removal of one of our service failure examples from Table 2.1 by a participant in the e-commerce field and adding two new examples by two participants in the IS field (also confirmed by other participants). No new idea appeared for Table 2.2 and Table 2.3 (our proposed typology) and they were confirmed by all participants.

2.3 DIGITAL SERVICE VALUE CHAIN FRAMEWORK

In this section, we present a brief overview of the prominent service value chain frameworks and our designated digital service value chain framework for e-commerce websites. The service value chain framework presents a view of service-related activities in many service industries (Alter, 2008; Tate et al., 2014). However, some of these activities are not important for some service systems[13] (Alter, 2008) (i.e. not all of the service activities in the framework are necessary to be followed in co-production of some services). Based on the co-production view, Alter (2008) developed a service value chain framework that presents the service provider's and the customer's roles and responsibilities from the 'awareness of the need for a service' to the 'follow up' stage by both customers and service providers.

[13] A service systems is a work system in which "human participants or machines perform work using information, technology, and other resources to produce products and services for internal or external customers" (Alter, 2008, p. 73).

The stages of Alter' (2008) framework include: 'awareness of the service' ('creating awareness of the service' by service provider and 'becoming aware of the need' by customer), 'negotiate commitment' by both service provider and customer, and the group of 'service production and consumption' activities. The 'service production and consumption' activities are divided into two sub-groups of co-production activities on the service provider's side and co-production activities on the customer's side. The co-production activities on the service provider's side include: 'provider set up', 'handling service request', 'fulfilling service request', 'customer facing follow up', and 'service provider's internal follow up'. The co-production activities on the customer's side include 'making service request', 'customer preparation', 'participation in service fulfilment', 'provider facing follow up', and 'customer's internal follow up'. According to the framework, both service providers and customers receive a value (e.g. saving time and experiencing a more transparent process of service production and delivery) at all stages of co-producing the service in the service value chain.

As an example, a bank customer who has become aware of the need to apply for a loan, needs to request in the form of an online application (i.e. making service request) through the bank's dedicated registration system. After submitting the request, automated backstage processing is done to determine the terms and conditions of available loans for the customer, to assess rates, to verify that the customer data is complete and correct, and finally, to fund the loan when the customer accepts the offer (i.e. the fulfilment process). After receiving the loan, the customer needs to submit monthly payments to the bank and the bank checks whether payments are complete monthly (i.e. the follow-up stage by both the customer and the bank).

In addition to Alter (2008), Eshghi, Gangui and Nasr (2012) offered a service value chain framework. The stages of the framework include initial contact with service provider, service delivery and use, the occurrence of service problems and service problem recovery. However, the framework consists of three very general steps (one of which is service recovery) and it does not apply the concept of co-production in the service setting (it only mentions 'service delivery and use', not service co-production and use). Also, it does not develop or clarify the service recovery sub-process in any depth and does not consider service failure prevention. Moreover, we argue that considering the activities of service failure recovery as the last step of the framework is over

simplified, since different types of service failure are likely to happen at different stages of digital service co-production and usage activities.

While these models are valuable, they have some limitations for our purposes. Considering the fact that services are often co-produced by service providers and customers, Alter's (2008) is the most appropriate service value chain framework from this perspective; however it does not specifically address *website* service activities. Similarly, it provides a very general view of service activities for all types of service industries, and therefore does not necessarily provide actionable insights for specific types of services and technologies. For example, the conceptualisation of 'negotiation commitment' by Alter (2008) is more suitable for traditional ways of delivering and receiving service. In a digital context, it can be performed just by clicking the appropriate option on the dedicated webpage to determine the Service Level Agreement (e.g. how much data and for how long a consumer aims to purchase from an ISP). Therefore, we felt that a new and more granular digital service value chain was required for the purposes of this study. We propose a new framework based on the two leading models including Alter's service value chain framework, and the customer purchase decision making model (Elliott, Rundle-Thiele and Waller, 2010).

The steps of the decision making model are flexible (e.g. a customer may return to a previous step during the process) and apply to both customer decision making to purchase a product or a service via an e-commerce website (Elliott et al., 2010). The model includes five steps, including 'need recognition' (customer becomes aware of his or her needs/wants as the result of marketer's activities), 'information search' (the customer seeks information from trusted, known or any available sources, such as online reviews of a product), 'evaluation of options' (the customer ranks available options and alternatives, and considers whether to purchase and other use of money), 'purchase' (where the customer chooses a specific product, a service or a brand, decides to purchase or not to purchase, and follows the purchase activities or cancels an order), and 'post purchase evaluation', where the customer continues to evaluate the product or service after his or her purchase (e.g. assessment of attitude toward the product or service, quality of service provider's performance and/or the quality of their website) (Elliott et al., 2010).

The stages of customer purchase decision-making model complement the stages of service value chain framework proposed by Alter (2008). For example, the 'need recognition' step in the decision making model is equivalent with 'become aware of the need' step in Alter's framework, 'information search' and 'evaluation of options' steps in the model can be considered between 'become aware of the need' and 'negotiate commitment' steps in Alter's framework, and the 'service consumption' steps in Alter's framework can present more detailed steps for 'purchase' step in the model. Therefore, a modified combination of these two models provides a suitable service value chain framework for digital service delivery. Figure 2.1 illustrates our digital service value chain framework which presents a combination of the steps of Alter's (2008) framework and the steps of customer purchase decision-making model, and is modifies for e-commerce websites.

The figure presents nine sequential steps of producing and receiving a service from the customer's perspective (from need/want recognition to post-purchase evaluations) and seven sequential steps from the service provider's perspective (from creating awareness of the service to post-purchase evaluations). This enabled us to provide richer insight into service failure by classifying the exact stage at which a consumer's expectation of the service is formed (i.e. evaluation of products, services and brands) and the stage (i.e. making service request) from which service failures may happen. The outcome is a value chain that enables us to organise the *technological enablers* we identified according to the *type(s) of service failure* they can prevent *at a stage* in the value chain. It also assists us to organise prevention enablers according to whether they are usable by *customers or service providers*. Drawing these dimensions together provides a rich and nuanced typography.

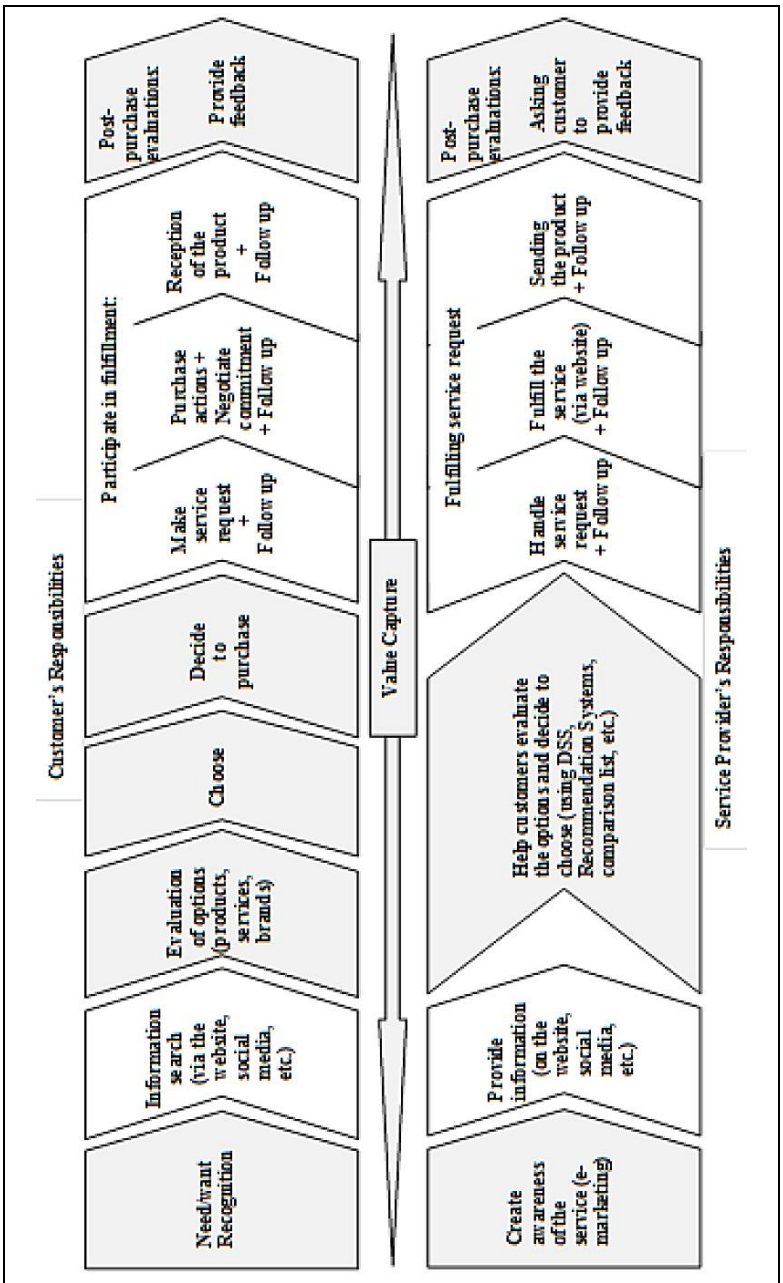

Figure 2.1: Digital Service Value Chain Framework

2.4 TYPES OF WEBSITE SERVICE FAILURES

We use the categorisation and definitions of digital service failures developed by Tan, Benbasat and Cenfetelli (2011, 2016) as it is the most relevant, comprehensive and contemporary study we were able to identify. According to this categorisation, there are three types of service failures associated with website performance namely, Informational Failures, Functional Failures and System Failures. Website functional failures happen when the functionalities provided on the

website are unable or insufficient to support customers in the accomplishment of an activity related to the production and/or delivery of a service (e.g. insufficient payment options or occasional problems in payment due to system security issues). Informational failures happen if the information provided on the website is incapable of conducting customers in the accomplishment of transactions and fully benefiting from the website functionalities (e.g. irrelevant, inconsistent or incomplete information). System failure is the situation when the functionalities provided on the website are not delivered properly (e.g. due to the website navigational problems, lack of interactivity, or problems in the networking security), and therefore customers will be unable to benefit from the website functionalities and accomplish their transactions satisfactorily. We emphasise that a functional failure is a failure in meeting user's functional requirements/expectations. Note that by functional requirements we mean the user's goal for using the service system. An example is the user may have a requirement to communicate with a community of other customers and respond to threads via a discussion forum.

According to the general definition of service failure from expectation confirmation theory, and the specific definitions for each type of service failure by Tan et al. (2011, 2016), we can see that functional failures are the central type of digital service failures and are caused in turn by: 1) absence or insufficiency of required website functionalities to complete the expected service satisfactorily; 2) functionalities that are present, but do not function satisfactorily due to system failures; 3) functionalities that are present, but do not function satisfactorily due to informational failures (e.g. misleading information before and/or while completing the service).

The next section presents a comprehensive review of the technological enablers to prevent different types of service failures and describes each of them briefly.

2.5 TECHNOLOGICAL ENABLERS FOR WEBSITE SERVICE FAILURE PREVENTION

This section presents the technological enablers (i.e. specific technologies and technological approaches) that can be used to prevent website service failure. As we discussed, functional failures are the central type of service failures and are caused in turn by "system failures", "informational failures" and/or "lack or insufficiency of the required website functionalities".

Accordingly, in order to prevent website functional failures, service providers can employ the following types of technological enablers[14]:

- Technological enablers to prevent system failures.
- Technological enablers to prevent informational failures.
- Technological enablers to identify the lack or insufficiency of required website functionalities and provide them on the website (i.e. preventing repetition of this type of failure in future)

Technological enablers to prevent website functional failures as the result of system failures

In the general context of technological enablers for website functionalities and capabilities improvement, Napier, Judd, Rivers and Adams (2003) classify the system related technological enablers into the enablers for "networking" and "security" (including internal, external and transactional security). Therefore, for the specific context of technological enablers for system related service failure prevention, we categorise these technological enablers into:

- Prevention from "networking" related failures
- Prevention from "security" (internal, external and transactional security) related failures

This section provides a description for the technological enablers including both the specific technologies and technological approaches to prevent "networking" and "security" related failures, separately. We start with a brief description of the technological approaches to prevent "networking" related failures (e.g. disconnections or changes in data transmission speed which can lead to unsatisfactory waiting time for customers when uploading a document to an online registration system or when downloading an application or video content from a website). As these approaches provide fast (real-time error detection and recovery) solutions for service providers, they can prevent or minimise the possibility service failure occurring in the mind of customers. Note that in keeping with the focus of our paper, we describe briefly the business functionality provided by each technological enabler. References are provided to enable readers to access more in-depth technical descriptions.

The technological approaches to prevent "networking" related failures include:

[14] We note this includes the situation where they are used to provide self-help for customers.

- Content Caching and Streaming Media Caching: Online service providers can store and move frequently requested content closer to customers (i.e. content caching). This reduces traffic to the original server and therefore, handling of the customers' requests and purchases can be performed more quickly. A similar process can be used for streaming media caching which allows service providers to prevent unsatisfactory waiting time for customers when downloading video and audio content (Napier et al., 2003; Lamberti and Sanna, 2007).
- Multiple Stage Adaptation: In order to acquire and retain customers, e-businesses have to modify or increase service options; therefore, they may experience changes in network configurations and quality of service (QoS) offerings. In this situation, failure of component services and other negative consequences will be probable (Chafle, Dasgupta, Kumar, Mittal and Srivastava, 2006). Multiple Stage Adaptation helps the system to adapt itself and react effectively to these changes by employing a different type of service or different template of services for a fast compensation of failed service. See Chafle et al. (2006) for more information on this approach.
- Dynamic Substitution and Control Flow Intervention: Control Flow Intervention is an automatic service substitution at runtime in a service composition. It dynamically replaces faulty services by semantically equivalent ones (Moller and Schuldt, 2010). Like the previously mentioned dynamic and automatic approaches, as this approach provides a fast solution for service providers, it can prevent occurrence of a real service failure in the mind of customers.
- Backup Path: A backup path (second path) can be created for each service in a service composition; therefore, if the optimal path fails to accomplish the purpose, the current and future executions can continue through the second path (Yu and Lin, 2005). See Yu and Lin (2005) and Feng, Wu, Wang, Ren and Guo (2007) for more information on this approach.
- Multiple QoS Constraints: Many web services are a composition of multiple technical services from multiple providers (e.g. network, merchant and bank). Since for each of the services in the composition a different quality of service (QoS) may be specified by different SLAs, there will be the possibility of a service failure as the result of this complexity. The Multiple QoS Constraints approach dynamically finds a new path that starts from the preceding service by maximising or minimising some QoS values (Feng, Wang, Wu and Zhou, 2007). See Feng, Wu, Wang, Ren and Guo (2007) for more information on this approach.

- Rebinding: In order to meet the requirements of a QoS in the situations like unavailability of a service, this approach is capable of early run-time re-binding for functionally equivalent services in a service composition. See Canfora, Di Penta, Esposito and Villani (2008) for more information on this approach.
- Performance Prediction: Online services are offered through the dynamic and changing environment of the Web (e.g. changes in data transmission speed) which leads to frequent changes in the QoS. Dai, Yang and Zhang (2009) used performance prediction approach and proposed a self-healing solution that dynamically finds a backup during the execution. As this approach minimises the re-selections during the execution, the system is capable of healing itself fast.
- Region Reconfiguration: In a service oriented architecture, many service processes are composed of services from some other service providers. Therefore, if an error happens in a service, it may cause a failure for end-to-end QoS constraints. Using an iterative algorithm, this approach prevents a failure in the whole service process by dynamically replacing that service by some of its neighboring services in the region of that QoS (Lin, Zhang, Zhai and Xu, 2010). See Lin et al. (2010) for more information on this approach.

The specific technologies to prevent "networking" related failures include:

- Cache Servers and Content Delivery Networks: Using cached servers (between the origin servers and customers in content delivery network), service providers can store and move frequently requested contents closer to customers. As the traffic to the origin server is reduced, handling customer's requests and purchase process can be performed with less waiting time. A similar process can be done for streaming media caching for video and audio content delivery (Napier et al., 2003; Lamberti and Sanna, 2007).
- Watchdog systems: dynamically prevent software or hardware failures that may lead to a failure in the efficiency of the system by periodically checking the signals sent through the system components (Ibrohimovna and Groot, 2010). Also, they can be used to monitor the attempts to access websites from different locations periodically and inform service providers of access failures through online reports (e.g. via email).
- SLA Monitor and SLA Management System: SLA monitors can be used to ensure that the service (especially cloud services) fulfills the QoS requirements of SLA by observing the

runtime performance. SLA management system processes this data (gathered by the SLA monitor) to be used for SLA reporting metrics and control. Watchdog systems and this technology are used together by many digital service providers for the purpose of fast and dynamic error detection and failure prevention (Mosallanejad, Atan, Murad and Abdullah, 2014).

The technological enablers (technologies and approaches) to prevent "networking" related failures (as a subset of system failures) were described above. The technological enablers to prevent "security" related failures (as the other subset of system failures) are described in the following section.

In addition to the technologies (e.g. password, biometric and smart card identification systems for authorised access) and approaches (e.g. disaster recovery plans, backup and restore policies, risk management processes, email/spam filtering, and employee education and awareness) that can be employed to prevent "internal" security risks originating from inside the business, technological enablers that can prevent "external" and "transactional" security related failures must also be considered by the firms. External security related failures can happen because of infections resulting from viruses, worms and Trojan horses or because of unauthorised access that may lead to fraud (stolen data is misused or modified) or network intrusion by hackers. For e-businesses, other security failures are Denial of Service Attacks (disabling the network by flooding it with confusing traffic) and Website Defacement (i.e. changing the contents of webpages by for example modifying the HTML).

In a more detailed study of web attacks, Shah (2002) categorises these attacks into the five groups of URL Interpretation Attacks, Input Validation Attacks, SQL Injection Attacks, Impersonation Attacks and Buffer Overflow Attacks. Shah (2002) also explains the most frequent techniques that hackers use for these web attacks. These include URL Misinterpretation, Directory browsing, Retrieving non-web files, Revers Proxying, Java Decopilation, Source Code Disclosure, Input Validation, SQL Query Poisoning, Session Hijacking and Buffer Overflows. Because the audience of this paper are mainly *business* academics and practitioners, we refer readers to Change, Kuo and Ramachandran (2016), Chomsiri (2007), Gehling and Stankard (2005), Kong, Xu and Zeng

(2010), Moradian and Håkansson (2006), Rane, Kulkarni, Patil and Meshram (2012) and Shah (2002) for detailed technical information on how to prevent these web attacks. Practitioners who are interested in this area can also gain more detailed technical information from well-established resources and workshops, such as certifications and workshops related to Certified Information Systems Security Professional (CISSP).

In addition to the internal and external security failures, e-business transactional related failures can lead to serious negative consequences for the customer's trust in transactions with service providers. In the context of e-business, the necessities of transactional security include confidentiality, authentication, integrity and nonrepudiation. As explained below, among the technological enablers for preventing security related failures, security protocols, Public Key Infrastructure (PKI), digital signature and digital certificates are the ones that can prevent (some, not all) e-business transactional related failures. Other technological enablers such as firewalls and proxy servers are used for more general security purposes. The technological approaches that can prevent security (external and transactional security) related failures include:

- Security Protocols: includes the communication and payment protocols specially, Secure Socket Layer (SSL) and Transport Layer Security (TLS) for securing communication channels, and the protocols including Secure Electronic Transactions (SET), e-Cash, Secure Payment Application (SPA) and 3D Secure for securing payment data from alteration during transmission (Yasin et al., 2012; Kizza, 2013; Niranjanamurthy and Chahar, 2013; Manakshe, Jirkar, Wakhare and Buram, 2014).
- Public Key Infrastructure (PKI): E-businesses who participate in a PKI and use the digital certificate (explained further below) can check the public keys of other organisations in the network. PKI creates digital certificates, securely stores them in a public repository and disproves them if necessary (Napier et al., 2003; Tyagi and Srinivasan, 2011; Kizza, 2013).
- Technical Security Audits and Penetration Tests: In addition to assessment of the security plans and procedures (i.e. organisational audit) and the assessment of physical security of hardware (i.e. physical audit), a complete security audit scans the network security internally and externally (penetration tests) to identify the potential weaknesses (i.e. technical audit) (Napier et al., 2003; Gehling and Stankard, 2005; Tyagi and Srinivasan, 2011; Marchany and Tront, 2002; Yasin et al., 2012; Niranjanamurthy and Chahar, 2013; Kizza, 2013).

In addition to updated antivirus software to prevent system infections, the specific technologies that can prevent the security related failures include:

- Firewalls, VPN, Proxy Server, Network Address Translation (NAT) and Filters: Firewalls (generally categorised as packet-filtering, circuit-level, and application-level firewalls), VPN (a combination of firewalls, public and private key encryption and digital certificates), Proxy Servers and NAT (can be separately used to protect the user's IP address) and filters (to block the spurious traffic in a distributed denial of service attack) are common technologies used by many digital service providers to prevent the system security related failures. The SSL protocol and digital certificates are described in this section. See Kizza (2013), Gehling and Stankard (2005) and Niranjanamurthy and Chahar (2013) for more information.
- Network Scanning and Network Intrusion Detection Software: help to detect weaknesses of the network security and also can identify the hacker attack threats. Moreover, this can be done in the form of "vulnerability monitoring", which involves a continuous scanning to find potential problems that match the characteristics of the known threats in the 'threat database'. The data can help to resolve the problem and also can be used to analyse patterns of suspicious behaviour. Some of these tools can also help to develop Threat Models when developing the system to help preventing exploits in future (Napier et al., 2003; Tyagi and Srinivasan, 2011; Marchany and Tront, 2002; Yasin et al., 2012; Niranjanamurthy and Chahar, 2013; Kizza, 2013).
- Information Security Software / Shareware Tools: Many information security management solutions are now sold in the form of the tools such as software for website traffic analysis, proxy server reporting, quality control, monitoring and recovery for limited or unlimited number of devices, and also to build secure payment systems (Tyagi and Srinivasan, 2011; Marchany and Tront, 2002; Yasin et al., 2012).
- Cookies "marked as secure": cookies are primarily used to store authentication and user information and preferences. Also, they can be used to track user activities; therefore, using the cookies that store encrypted data and passing them through SSL enhances a secure online shopping experience (Niranjanamurthy and Chahar, 2013).
- Digital Signature: Depended on the type of an e-business, digital signature may be necessary for the negotiation phase of the purchase process between service providers and their customers. A digital signature provides the recipient the proof of authentication, non-

repudiation and integrity of the message (i.e. the message has not been altered during the transmission) (Tyagi and Srinivasan, 2011; Marchany and Tront, 2002; Niranjanamurthy and Chahar, 2013; Kizza, 2013).

- Digital/Electronic Certificate: is a digital credential of an e-business on the Web. It is issued by a certificate authority to provide this security assurance for the e-businesses that if they are going to exchange encrypted data with other parties, these parties are actually who they claim (Yasin et al., 2012; Niranjanamurthy and Chahar, 2013; Kizza, 2013).

According to the above descriptions, PKI, digital certificate and also technical security audits and penetration tests are useful for precautionary considerations that should be considered *before* starting service transactions. For example, customers may check the digital certificate of a service provider during the "evaluation of options" (e.g. services, products, brands, service providers) phase of the service value chain framework (i.e. before starting and receiving a service from a specific service provider). In summary, they are not included among the technological enablers that can prevent website service failures once a customer has started a service transaction by requesting a service.

Technological enablers to prevent website functional failures as the result of informational failures

Sometimes functional failures occur not because of the system failures, but because of informational failures. However, it is always possible that the information provided by the website and service provider is complete and presented properly, but due to occasional customers' mistakes (e.g. not paying attention to guidance or warning/error messages), the consumer does not fulfil his/her intended actions satisfactorily. Customers have an essential role in co-production when using self-service technologies such as websites, and therefore in service failure prevention. Service providers can use appropriate technology enablers (e.g. online chat capabilities, creating online community of users webpages, links to the firm's social media pages, online tutorials, etc.) on the website to communicate with customers and/or educate them to help them prevent, or at least minimise, the possibility of some functional failures.

- Self-Help Resources: Dedicating a part of the website to frequently asked questions (FAQs), customers' community webpages, links to the (service provider's) social media pages, online

video training sessions and tutorials for the purpose of educating customers and prevent customers' mistakes that can lead to service failure. It is important to mention that although sometimes service failures happen because of the customer's mistakes when working with technology, it is the responsibility of the service providers to educate customers and provide facilities for them to avoid from these mistakes (Kasabov and Warlow, 2009; Kasabov, 2010; Nili and Keramati, 2012).

- Automated Messages and Pop-Up Windows: can provide guidance and directions for customers while they are proceeding through the purchase process. Therefore, they can help to prevent some potential customer's mistakes during the purchase activities (e.g. preventing from mistakes in selecting the same product twice and being charged more than what they were expecting).
- Social Media Pages, Online Chat Sessions (with service personnel) and Instant Messaging: These can help customers and service providers to interact in a way that they can prevent the occurrence of service failures due to either of customer's or service provider's mistakes (e.g. answering to the customers' general enquiries or specific enquiries when they detect a potential problem with the website or informing customers to avoid using the website until a problem is resolved) (Kasabov and Warlow, 2009; Kasabov, 2010; Nili and Keramati, 2012).
- Online Feedback Forms: for receiving customers' feedback about the quality of the services, product, and also their comments on how to improve design quality, and therefore preventing occurrences of similar failures in the future (Kasabov and Warlow, 2009; Kasabov, 2010).
- Electronic Status Reports: can be used in the form of a webpage, automated email or messages to explain the current status of the recovery process for a system error that has already happened. This can help to minimise the risk of a real service failure occurring in the mind of customers (customer's perception of service failure) as they become aware of the service provider's attempts for a fast resolution (Kasabov and Warlow, 2009; Kasabov, 2010).

Technological enablers to prevent lack/insufficiency of the website functionalities

According to Napier et al. (2003), Kizza (2013), Kasabov and Warlow (2009) and Kasabov (2010), the technological enablers to identify the failures related to the lack or insufficiency of the website functionalities and prevent repeating them in future include:

- Genetic Algorithms, Neural Networks and Fuzzy Logic: to classify and route the service failure causes for analysis and design improvement (i.e. root cause analysis) for the purpose of preventing their repeated occurrence in the future.
- Data Warehousing and Data Mining: separate databases can be used for maintaining "value failure data" and to help analysis of service failures to prevent their occurrence in future.
- Online Feedback Forms: for receiving customers' attitudes toward the quality of the services, product, and also for receiving comments on how to improve the quality of the website design and therefore, preventing from occurrence of similar failures in future.
- Intelligent Agents (IA): Can provide the capabilities such as personalisation of the website contents, as they gather and analyse individuals' preferences based on their shopping behaviour. These IAs can be used as shopping assistants to help finding a desired item without the need to browse many webpages. This ability can help to prevent a (perceived) long time delay needed to find a desired item (i.e. a perceived service failure by some customers). Moreover, in the event of service failure IAs can be used to earmark severe failures. This helps service providers in analysing data related to these failures and prevent them in future.

The previous sections presented the technological enablers that service providers and/or customers can use to prevent website service failures. However, it is important to mention that perceived service failures (from the customers' perspective) can still occur when the website has all of the required functionalities, there is no problem with the system and the necessary information is available for the customer's purchase activities. This can be due to the problems on the customer's side (e.g. an out of date version of web browser that is not supported, or lack of required software). Although in this case, there is no problem with the website itself, it is always the service provider's responsibility to ensure that they have provided all of the means required for a convenient service experience and failure-free services for customers. Web browser Plug-Ins are the technology enablers that can help to overcome this issue by adding new features and capabilities to a customer's web browsers (e.g. the ability of playing video for the online self-help tutorials). In addition to this, e-businesses can provide links to a specific web browser, required software or the latest version of the software; therefore, customers will benefit from the website functionalities with higher efficiency and less probability of dissatisfaction.

2.6 A TYPOLOGY OF TECHNOLOGICAL ENABLERS FOR PREVENTING WEBSITE SERVICE FAILURES

In this section, we first present some common examples for each type of service failures that can occur at each point in our digital value chain framework (Table 2.1). Then, we provide a typology of the technological enablers based on their suitability for preventing from each type of service failure that may occur at a point in the digital service value chain.

Table 2.1 presents some common examples of informational failures, systems failures and lack/insufficiency of website functionalities that can lead to website functional failures at a point in the digital service value-chain of e-commerce websites. These failures typically occur from the 'making service request' stage of the service value chain onward.

Table 2.1: Examples of the Service Failures that May Occur in Each Related Phase of the Website Service Value Chain Framework

Consumer's Roles in Co-Production by Websites arranged by phase in the Digital Service Value Chain:			
Participate in fulfilment			Post-purchase Evaluations
Make service request + Follow up	Purchase actions + Negotiate commitment (e.g., SLA) + Follow up	Reception of the product + Follow up	Providing feedback
Service Provider's Roles in Co-Production by Websites arranged by phase in the Digital Service Value Chain:			
Handle service request + Follow up (e.g., automated messages or confirmation)	Fulfil consumers' purchase activities + Fulfil Negotiate commitment + Follow up	Sending the product (electronically or to residential address) + Follow up	Asking customers to provide feedback on the service delivery
Examples of Service Failures Leading to Website Functional Failures from a customer perspective:			
Informational Failures			
Listing an unavailable item in the list of available items, not enough self-help resources (e.g., FAQs, instructions) to gain information on the purchase process.	Lack or misleading guidance and directions during purchase, no information on the current status/stage of service delivery	No receipt of payment and/or product specification	Not providing an estimation of the time needed to fill in the feedback form
System Failures			
Communication security issues, compatible only with a specific web browser, host overload (due to high number of requests)	Navigation problems, delay in loading a webpage, communication and payment security issues	Unacceptable waiting time for downloading a software or a video file	Problem with submission of feedback
lack/insufficiency of the website functionalities			
Search capabilities are not provided	Lack/insufficient payment options	Lack of options/methods of receiving the product	Lack of feedback form or any channel of communication with service provider

As we explained, services (especially the ones offered via websites) are often co-produced. Therefore, we present our typology based on the technological enablers that can be used by *service providers* (see Table 2.2) and also based on the technological enablers that can be used by

customers (Table 2.3) for each type of service failure. These technological enablers are also presented from the 'making service request' stage of the digital service value chain.

Table 2.2: A Typology of the Technological Enablers that Can Be Used by Service Providers for Website Service Failure Prevention

<table>
<tr><td colspan="4">Service provider's roles in co-production by websites:</td></tr>
<tr><td>Handle service request (by the provided website) + Follow up (e.g., automated messages or confirmation)</td><td>Fulfill consumers' purchase activities + Negotiate commitment (if needed) + Follow up</td><td>Sending the product (e.g., via download) + Follow up</td><td>Asking customers to provide feedback on the quality of service</td></tr>
<tr><td colspan="4">Technological enablers to prevent from the website functional failures as the result of Informational Failures:</td></tr>
<tr><td colspan="3">1) Providing links to the (service provider's) social media pages, customers' community webpages, FAQs, and online video training and tutorials and instructions.
2) Automated messages and pop-up windows to provide guidance /directions
3) Providing online chat sessions (with service personnel), instant messaging, and social media pages
4) Electronic status reports via webpage, automated email or messages</td><td>5) Service provider's social media pages, online feedback forms, online chat capabilities, and customers' community webpages</td></tr>
<tr><td colspan="4">Technological enablers to prevent from the website functional failures as the result of System Failures:</td></tr>
<tr><td>1) Web browser plug-ins
2) Links to a compatible web browser or required software and/or their latest version</td><td>3) Digital Signature</td><td>4) Caches Servers and Content Delivery Networks
5) Content Caching and Streaming Media Caching</td><td rowspan="2">6) Service provider's social media pages, online feedback forms, online chat capabilities, and customers' community webpages</td></tr>
<tr><td colspan="3">7) Firewalls, VPN, Proxy Server, Network Address Translation (NAT), and Filters
8) Network Scanning and Network Intrusion Detection Software
9) Information Security Software / Shareware Tools
10) Cookies 'marked as secure'
11) Security protocols
12) Backup Path
13) Performance Prediction
14) Dynamic Substitution and Control Flow Intervention
15) Multiple Stage Adaptation
16) Multiple QoS Constraints
17) Rebinding
18) Dynamic/Region Reconfiguration
19) Watchdog system
20) SLA Management System and SLA Monitor</td></tr>
<tr><td colspan="4">Technological enablers to prevent from the website functional failures as the result of "lack or insufficiency of the website functionalities" and preventing from repeating them in future:</td></tr>
<tr><td colspan="3">1) Genetic Algorithms, Neural Networks, and Fuzzy Logic
2) Data Warehousing and Data Mining
3) Intelligent Agents
4) Service provider's social media pages, online feedback forms, and online chat capabilities (for receiving feedback during the purchase process).</td><td>5) Service provider's social media pages, online feedback forms, online chat capabilities, and community webpages</td></tr>
</table>

Table 2.3: A Typology of the Technological Enablers that Can Be Used by Customers for Website Service Failure Prevention

Consumer's Roles in Co-Production by Websites:			
Participate in fulfillment			Post-purchase Evaluations
Make service request + Follow up	Purchase actions + Negotiate commitment (e.g., SLA) + Follow up	Reception of the product + Follow up	Providing feedback
Technological enablers to prevent from the website functional failures as the result of Informational Failures:			
1) Using the links to the (service provider's) social media pages, customers' community webpages, FAQs, and online video training and tutorials and instructions. 2) Paying attention to the guidance/directions provided by the automated messages and/or pup-up windows 3) Using the online chat sessions (with service personnel), instant messaging, and social media pages 4) Paying attention to the electronic status reports via webpage, automated email or messages			5) Service provider's social media pages, online feedback forms, online chat capabilities, and customers' community webpages
Technological enablers to prevent from the website functional failures as the result of System Failures:			
1) Using/accepting Web browser plug-ins (if needed) 2) Links to download a specific web browser or software and/or their latest version (if needed) Paying attention to whether the service provider uses: 3) The security protocols for communication and/or payment 5) Cookies 'marked as secure' (if needed) 6) and whether uses digital signature (if needed)			5) Service provider's social media pages, online feedback forms, online chat capabilities, and customers' community webpages
Technological enablers to prevent from the website functional failures as the result of "lack or insufficiency of the website functionalities" and preventing from repeating them in future:			
1) Using links to the (service provider's) social media pages, customers' community webpages, FAQs, and online video training and tutorials and instructions. 2) Using social media pages, online chat sessions (with service personnel), and instant messaging			3) Service provider's social media pages, online feedback forms, online chat capabilities, and customers' community webpages

2.7 DISCUSSION AND CONCLUSIONS

This paper contributes to both IS theory and practice by developing a typology of the technological enablers (both technologies and technological approaches) for preventing different types of e-commerce website service failures, including technological enablers that can be used by service providers and the technological enablers that can be used by customers. We also provided a brief description for each of these technological enablers from a business perspective, and references to resources where a more detailed technical explanation can be obtained. As already mentioned, compared with the service value chain of many types of ITs, the service value chain of e-commerce websites includes several various steps/stages of digital service production and delivery. Various technological reasons may cause a digital service failure at each point of the service value chain of e-commerce websites. Therefore, we believe that our designated typology can be useful for preventing from the failures with many other digital services offered via other types of IT.

As our typology clearly shows, an interesting finding is that among these technological enablers, social media can be widely used by both customers and service providers to prevent service failures at many stages of the framework (even at the "post-purchase evaluations" stage). Different types of social media have different characteristics (e.g. information richness and cultural issues) and can have a variety of forms, many of which are free and also capable of being provided through dedicated webpages of a website. As these features can show the high potential of wider use of social media for the purpose of service failure prevention, we encourage future research to consider these different characteristics in how social media can be effectively used at different stages of our framework. We can also see that many of the technological enablers (particularly the ones for preventing network problems) can be useful for most stages of the value chain. As a result, we recommend considering these enablers as a priority when implementing the enablers presented in the typology since they have a significant role in preventing website service failures.

Another major conclusion is that effective service management requires deep understanding and cooperation between business and IT specialists. Our paper contributes to this by bridging technical and managerial (customer service) perspectives on preventing service failure. Therefore, as our second suggestion for future research, we suggest deeper investigation of the business and technology service management issues involved in each stage of our service value chain framework, and the inclusion of other relevant enablers such as managerial enablers of service failure prevention.

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Chapter 3

A FRAMEWORK AND APPROACH FOR ANALYSIS OF FOCUS GROUP DATA IN INFORMATION SYSTEMS RESEARCH[15]

Abstract: A significant part of information systems research aims to study people as a part of a system, organisation, network or community. Since this research focuses on data related to the interaction of individuals, focus groups can provide data that cannot be obtained through any other method. This emphasises the importance of having a clear and systematic *analysis* framework for focus group data. However, compared with the abundance of handbooks and guidelines on how to *plan* and *conduct* focus groups, little methodological literature is available on how to *analyse* focus group data. In this paper we provide a systematic and integrative approach for qualitative analysis of different types of focus group data (e.g. group level content and interaction data) for Information Systems (IS) researchers. While we focus on IS research, our framework is also relevant to other applied business disciplines.

Keywords: Focus Group, Qualitative Analysis, Analysis Framework, Information Systems

3.1 INTRODUCTION

Focus groups are a social method of obtaining research data through informal group discussions on a specific topic (O'hEocha, Wang and Conboy, 2012; Parent, Gallupe, Salisbury and Handelman, 2000). Compared to other methods such as individual interviews and surveys, the interactive and synchronous group discussion aspect of focus groups allows participants to discuss, agree or dissent with each other's ideas, and to elaborate the opinions they had already mentioned. Therefore, not only does the method help attain a deeper shared meaning of responses that enhances the trustworthiness of research results (Kitzinger, 1994; Stahl, Tremblay and LeRouge, 2011), but also it provides the unique opportunity to obtain rich group interaction data (Onwuegbuzie, Dickinson, Leech and Zoran, 2009; Stahl et al., 2011). This data is valuable for conceptualisation and theorising, especially for studies which explore the behaviours of individuals as part of a social system (Belanger, 2012). Such systems are popular foci for information systems (IS) research, many of which utilise focus group method. Examples include:

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user behaviour in social networks (Hundley and Shyles, 2010), evaluation of e-service quality of libraries (Einasto, 2014), consumer social interaction and online group buying behaviour (Zhang and Gu, 2015), artefact refinement and evaluation in design (Tremblay, Hevner and Berndt, 2010), and group decision making and planning (Glitz, Hamasu and Sandstrom, 2001). However, compared with the abundance of guidelines on how to *plan* and *conduct* focus groups (e.g. Liamputtong 2011; Stewart and Shamdasani, 2014; Wilkinson, 2004), there is little methodological literature on how to *analyse* focus group data (e.g. Grønkjær, Curtis, de Crespigny and Delmar, 2011; Halkier, 2010; Kitzinger, 1994; Onwuegbuzie et al., 2009; Vicsek, 2007) in the IS and social science literature, with many researchers assuming that general guidelines for qualitative data analysis will suffice (Onwuegbuzie et al., 2009; Stewart and Shamdasani, 2014). In this paper we develop a systematic and integrative approach for qualitative analysis of different types of focus group data (e.g. group level content and interaction data). Our framework is aimed specifically at IS researchers, but is also relevant to other applied business disciplines.

Qualitative data *analysis* methods have been challenged and criticised by social science and IS researchers for being unsystematic and ambiguous (Grover and Lyytinen, 2015). This characteristic of qualitative data analysis has been a topic of debates and repeated calls for new data analysis approaches and advances in the last three decades (e.g. Chen and Hirschheim, 2004; Galliers, 1991; Hirschheim, 1985; Orlikowski and Baroudi, 1991; Ramiller and Pentland, 2009). Concerns regarding the process of analysing qualitative data become even more critical when it comes to the analysis of focus group data as there is little guidance available. Methodological handbooks (e.g. Liamputtong, 2011; Stewart and Shamdasani, 2014; Wilkinson, 2004) and articles (e.g. Bertrand, Brown and Ward, 1992; Moretti, van Vliet, Bensing, Deledda, Mazzi, Rimondini, Zimmermann and Fletcher, 2011; Onwuegbuzie et al., 2009; Parent et al., 2000; Smithson, 2000; Vicsek, 2007; O'hEocha et al., 2012) specifically written about focus group method provide little information on focus group data *analysis* or simply refer readers to general qualitative data analysis methods that are mainly useful for analysis of individual-level data such as transcripts of individual interviews. Consistent with this assertion, Onwuegbuzie et al. (2009, p.15) state that "despite the widespread use of focus groups… it is surprising that few explicit guidelines exist on how to analyse focus group data in social science research".

Some studies (e.g. Kitzinger, 1994) have advocated for the importance of capturing interaction data in groups, for example through conducting unstructured sessions with acquaintances who have a unified goal but potentially different views (e.g. managers and administrators of an organisation, teaching staff with prior interactions, and nurses at a department of a hospital). While a few studies on the analysis of focus group method have emphasised the importance of analysing both group level content and group interaction data (e.g. Grønkjær et al., 2011; Kitzinger, 1994; Onwuegbuzie et al., 2009; Smithson, 2000; Stahl et al., 2011; O'hEocha et al., 2012), no study has suggested a systematic procedure of analysing these two types of data in an integrated way. Such lack of a detailed and systematic procedure of analysing focus group data may explain the paucity of IS research articles and doctoral dissertations which report group level content data and interaction data from focus groups.

It could be asked whether a research framework specifically for information systems is required for analysing focus group data. We believe that it is for several reasons. Firstly, information systems has a unique focus on the interactions between people and technology. Benbasat and Zmud (2003) suggested that IS research should focus on the IS artefact and its nomological net, which includes the use and impact of IT artefacts, as well as the capabilities and practices required to develop and manage them. In a similar line, Tate and Evermann (2009) argued that the focal domain for IS theories of attitudes and behaviours towards technology should be the *intersection* between the universe of possible affordances of a technology artefact and a customer's physical and mental characteristics and past experience. This means the focus is neither the specific internal characteristics of the technology nor the internal psychological states or social interactions of the customer, but the inter-relationship between them as perceived by the customer. This conceptualisation provides guidance for the level of theoretical sensitivity required for analysis of focus group data in IS research, as proposed in this paper.

Benbasat and Zmud (2003) argued that research by IS scholars that examined "constructs best left to scholars in other disciplines" should be avoided as it involves an "error of inclusion" (p. 190) of constructs that are the proper domain of fields outside IS. When we consider this in the context of focus group method, we can see that focus groups are valuable for IS research which aim to capture the perceptions of a group of people towards any aspect of an IT artefact or its nomological

net. We can also see that a research focus on the characteristics of the group itself, or the group dynamics, is likely to result in an error of inclusion, by focusing on psychological constructs best left to psychologists. Therefore, a certain level of sensitivity to interactions within a group is likely to be required for many IS topics (for example, to determine the extent of agreement or disagreement with a statement), but it is relatively unlikely that specialised psychological analysis of the interactions of focus group members will be required. We aim to provide discipline-specific guidelines that will capture an appropriate level of theoretical sensitivity in the analysis of focus group data that is appropriate for IS researchers. This should *support* analysis of observable verbal and non-verbal interactions with respect to the phenomenon of study but *exclude* (as a general rule) specialised psychological observation and analysis of the internal states of the participants.

Secondly, as the field of IS matures, there is an increasing trend for researchers to draw on research from within the field: "IS is relying more on IS references, and the trend is distinctly positive" (Grover, Gokhale, Lim, Coffey and Ayyagari, 2006, p. 291). These results suggest that the field is increasingly depending on its own knowledgebase as it strengthens its cumulative tradition. Journals such as MISQ and CAIS have published discipline-specific guidelines for research methodologies ranging from formative and reflective construct specification (MacKenzie, Podsakoff and Podsakoff, 2011) to literature analysis (Tate, Furtmueller, Evermann and Bandara, 2015), to Bayesian Structural Equation Modelling (Evemann and Tate, 2014). Similarly, leading IS conferences are increasingly including philosophy and research methods tracks. This paper therefore aims to contribute to the growing corpus of within-discipline methodological guidelines. We make no claims, however, that our guidelines are applicable exclusively to IS. Our guidelines may be equally relevant for research problems of other applied disciplines that aim to investigate the perceptions of a group of people towards a phenomenon of interest. In this respect our study offers potential to contribute to another disciplinary trend identified by Grover et al (2006); the increasing contribution of IS research to other disciplines.

These factors and the multi-disciplinary characteristics and frequent social focus of IS research (e.g. studies of communication, business processes, outsourcing relationships, leadership style for IS management, which all consider people as a part of system) shows that many IS studies would benefit from a richer analysis of different types of focus group data which includes verbal and non-

verbal content and interaction data to investigate and answer their research questions. The potential benefits of the focus group method for the IS research clearly show the need to develop a clear and rigorous focus group data analysis procedure for IS researchers. In this paper, we explain: the different types of focus group data; how to determine the level of precision required; and how to organise as well as prepare this data for analysis. Then, we present our focus group analysis framework illustrated with examples. Finally, the paper ends with some recommendations on improving the trustworthiness of focus group data analysis.

3.2 TYPES OF FOCUS GROUP DATA

Focus group data can be categorised into two main groups: content data and interaction data (Onwuegbuzie et al., 2009; Smithson, 2000; Nili, Tate, Johnstone and Gable, 2014). Content data is obtainable from transcripts of audio or video records and interaction data (e.g. when one or more participants agree, challenge, question, or support or disagree with a participant's response) can be best obtained through reviewing video records or by detailed observation notes taken during the focus group.

Both content and interaction data can be verbal (in the form of words and sentences) and non-verbal. Examples of non-verbal content data are when a participant expresses his or her opinion about moderator's question (not in interaction with other participants) through moving his or her head, and showing the extent or magnitude of something with his or her hands while answering a question. Also, examples of non-verbal interaction data include when a participant disagrees with another participant's opinion through a gesture; supports his or her idea through a facial expression; or changes the loudness or pitch of their voice.

Non-verbal data can contribute to accurate interpretation of verbal expressions, or change the meaning of them. It has been suggested that up to 90% of the communicative process is nonverbal (Fromkin and Rodman, 1983). This means that if only verbal expressions are analysed in research a rich data source will be lost. Non-verbal data can emphasise a verbal message (e.g. pausing before speaking, saying a word louder or leaning forward while talking) or substitute for a verbal message (e.g. waving hands showing having no opinion about something). It has been shown that

non-expert and ordinary people can accurately interpret the meaning of most non-verbal communications (Gabbott and Hogg, 2000; Gabbott and Hogg, 2001; Richards and Schmidt, 2014). Also, there is evidence (Fabri, Gerhard, Moore and Hobbs, 1999) that simple and readily understandable non-verbal data (for non-experts) are sufficient to convey the meaning of social and interpersonal interactions. There is therefore very strong justification for including non-verbal data in the transcription and analysis of focus group data to prevent meaning being lost.

Non-verbal type of content data and interaction data can be categorised into four types including kinesic (movements and postures of body), proxemic (interpersonal space when expressing one's opinion), paralinguistic (e.g. changes in volume of voice and pitch) and choronemic (pace of speech and length of silence) (Onwuegbuzie et al., 2009; Onwuegbuzie, Leech and Collins, 2010; Nili et al., 2014). Although paralinguistic and choronemic types are vocal, they are considered a non-verbal type as they are not clearly words or sentences. In fact, these two types of non-verbal data can be important by helping to clarify what a person means by his or her verbal response. An example of this is emphasis of a word or a change in the loudness of voice implying a level of confidence in the response. Current literature has provided some ways of recognising, collecting, documenting and interpreting such data. For example, Onwuegbuzie et al. (2009) and Bloor, Frankland, Thoms and Robson (2001) provide examples of using symbols to facilitate collection of all four types of non-verbal data during focus groups; Krauss et al. (1996) and McNeil (1992) provide comprehensive typologies of non-verbal data; Onwuegbuzie et al. (2010) suggests a table to facilitate interpretation of non-verbal data; and Ekman's (1972) study which suggests six fundamental non-verbal expressions of emotions (happiness, sadness, fear, anger, disgust and surprise). Table 3.1 presents the different types of focus group data and some examples for each of them.

Table 3.1: Different Types of Focus Group Data			
Types of Data			**Example**
Content Data	Verbal		Any participant's comment, expression, etc. in the form of words and/or sentences which is not in a conversation/interaction with one or more people.
	Non-verbal	kinesic	Bending down the whole body (showing shame), head hangs on contracted chest (showing sadness), showing the extent or magnitude of something with hands, etc.
		proxemic	Guard oneself, looking around or opening hands (to express how a person feels about his or her personal space).
		paralinguistic	Loudness, tempo, pitch fluctuation, etc. to show the level of one's emphasis or the extent he or she believes in something.
		choronemic	A long period of silence showing not having a ready answer, deeply thinking on an issue, etc.
Interaction Data	Verbal		Any participant's response, comment, expression, etc. to one or more people in the form of words and/or sentences.
	Non-verbal	kinesic	Clapping of hands after hearing a well-thought response, expanding chest and head erect showing aggression when responding to a comment, etc.
		proxemic	Getting close to a person to show friendship and affection.
		paralinguistic	Pitch fluctuation or changing the loudness of voice to remind a member of a group about something, to give a clue, etc.
		choronemic	Silence expressing feeling of being treated unrespectfully, avoiding intimacy, expressing that the participant does not aim to disclose any information in relation to a personal question, etc.

The type and nature of the focus group data and the research question will determine the theoretical sensitivity of non-verbal focus group data. For example, studies in machine/human communication might require specialised knowledge and psychological training for the data analysis. However, for the majority of IS research questions, we suggest that the additional levels of meaning conveyed by non-verbal data that are readily available to the non-specialist will likely be adequate for all practical purposes[16]. The first step of our analysis framework explains how to determine the theoretical sensitive types of data and the level of precision required to analyse them.

[16] While there may be specific exceptions, we would argue that IS studies requiring extensive psychological training are potentially suffering from "errors of inclusion" (Benbasat and Zmud, 2003); where the main focus of the research is outside the boundaries of the discipline.

3.3 DESIGN AND EVALUATION OF A FRAMEWORK FOR ANALYSIS OF FOCUS GROUPS

In this section we explain how we designed our focus group data analysis framework and how we evaluated it both during and after its design to ensure its utility.

3.3.1 Designing the Framework

Our goal here was to design a framework that could serve as a systematic and clear how-to guide for the qualitative analysis of different types of focus groups data in IS research. Such a framework would not be the only way that focus group data could be analysed, but it would suggest a systematic and rigorous way for both novice and experienced IS researchers who aim to use the focus group method in their research.

Our design of the framework started with reviewing the prior literature to determine the appropriate steps of a focus group data analysis procedure, seeking to build upon what qualitative methodologists and focus groups experts have mentioned in prior literature. We reviewed journal papers (regardless of their rank), books and highly-ranked conference papers which focus on the analysis of focus group data. A database search of the entire social science and IS research corpus available from our institution's library was the search method. We also checked the forward and backward citations which extended our search process to health and nursing literature. We excluded any paper which does not specifically focus on the analysis aspect (e.g. focuses on planning and conducting) of focus groups and any paper which only presents criticism on the qualitative analysis of focus groups without suggesting any specific guidance or solution. After three rounds of article selection and evaluation, we found eleven journal articles which have contributed ideas specifically for the analysis of focus group data. These eleven papers were mostly in the fields of health and nursing research, which have made extensive use of the focus group method. The papers fell into three broad groups, consisting of: (1) Bertrand et al. (1992), Moretti et al. (2011), O'hEocha, Wang and Conboy (2012), Onwuegbuzie et al. (2009), Sim (1998) and Vicsek (2007), which concentrated on the analysis of focus group content data; (2) Rothwell (2010), Grønkjær et al. (2011) and Kitzinger (1994), which focused on the analysis of interaction

data; and (3) Halkier (2010) and Duggleby (2005), which focused on both content and interaction data.

According to these papers there are two main approaches for analysing focus group data, including deductive analysis (or 'directed analysis' where the coding and categorisation are based on an existing theory or prior research) and inductive analysis (or 'conventional analysis' where codes and categories are identified inductively from raw data and without any preconceived codes or perspectives). Unlike the deductive approach, which aims to help refine or extend existing theory or the findings of a previous study, the inductive approach is useful where theory or prior research on a topic is limited; therefore, it can help to achieve richer understanding, new ideas and insights about a phenomenon, and develop a new theory (Halkier, 2010; Moretti et al., 2011). These eleven papers have mainly contributed ideas for the inductive approach. We selected this as our focus because of its contribution to achieving richer understanding and novel findings which can contribute to developing new IS theories.

Next, we reviewed each paper in detail and aimed to synthesise their suggestions on focus group data analysis. Such a synthesis could have been easier if the papers provided any specific analysis framework and if we could put together and synthesise their suggested analysis steps (e.g. see Peffers, Tuunanen, Rothenberger and Chatterjee, 2007 for how they synthesised seven design science papers to design their own design methodology). However, none of these eleven papers suggest such sequential steps or framework. Therefore, the result of our synthesis was an 'initial' process framework which consisted of seven steps in a nominal sequence (Table 3.2).

The steps of our analysis framework include (1) Determining and organising the theoretical sensitive types of data, (2) Reviewing the whole raw organised data to get a sense of the whole and identify content areas (i.e. parts of transcript or observation field notes that are directly related to each other), (3) Manifest analysis of content data within each content area (i.e. analysis of the readily understandable parts of the organised data within each content area), (4) Latent analysis of content data within each content area (i.e. analysis of the parts which need high level of interpretation to understand their underlying meaning), (5) Analysis of interaction data within each content area based on the interactions and discussions between participants, (6) Integration of the

results obtained through previous steps for each content area, and (7) Integration of the results of all content areas and reporting the whole results. See Appendix 3.1 for a brief definition of the frequently used concepts (e.g. content area, meaning unit, code, category, theme, etc.) in the qualitative analysis of focus groups and the different names each of this concepts have been called in the literature.

Table 3.2: The Steps of the Focus Group Data Analysis Framework	
1. Determining and organising theoretically sensitive types of data	
2. Identifying content areas	
Within each content area	3. Manifest analysis of content data
	4. Latent analysis of content data
	5. Analysis of interaction data
	6. Integration of the results within each content area (integration of the results obtained through steps 3 to 5)
7. Integrating and reporting the results of all previous steps for all content areas	

3.3.2 Evaluating the Framework

Next, we evaluated our framework as a design artefact, to ensure its utility in achieving its goal. In other words, we aimed to evaluate the framework to ensure its fitness to purpose by assessing its relevance (i.e. its usefulness and applicability for the qualitative analysis of focus groups in IS research; Venable and Baskerville, 2012) and its rigor (i.e. the probability of yielding incorrect findings through the framework is low; Venable and Baskerville, 2012). According to Venable and Baskerville (2012) and Peffers et al. (2007), evaluation of a research method can be naturalistic (real users using a real purposeful artefact for a real research activity) or artificial (lacking at least one of these three realities), and is usually done either during or after the design process (Peffers et al., 2007). When evaluating the utility of a new method, a new analysis framework, etc., evaluation is often limited to the analytical approaches such as rational argument, discussing the findings and receiving feedback from experts in research methodology. The rigor characteristic can also be evaluated through limited trials of empirical evaluation by triangulation of the findings through using a different method (Venable and Baskerville, 2012).

We evaluated the relevance and rigor of our framework both during and after its design. First, we started with the evaluation of the relevance of the research and the motivation for developing the

framework, by reviewing the on-going debates and general discussions on information systems research. We believe that new or improved methods of data analysis have the potential to support new forms of theorising.

When we consider some of the debates currently occurring in the field, such as Constantinides, Chiasson and Introna's (2012) call for more consideration of ethics and power structures in IS research, Agarwal and Dhar's (2014) call for more theorising based on the opportunity presented by big data, or Avison and Malauranet's (2014) call for data that 'speaks for itself', we see opportunities for contributions made by focus group data. Analysis of the group interactions in a focus group that we discuss in Table 3.7 might surface abuses of power and position such as those discussed by Constantinides et al. (2012). A focus group following the identification of trends based on analysis of a big data source such as those advocated by Agarwal and Dhar (2014) might add richness and insight as to why the observed effects are occurring. The direct accounts and interactions of focus group members could produce powerful, authentic data that speaks for itself as advocated by Avison and Malauranet (2014). For example, a chorus of widespread understanding and agreement to a position taken by one customer in a focus group might provide a powerful signal to marketers or designers about customer sentiment.

Next, we evaluated both the relevance and rigor aspects during the design process. We refined the framework through discussion, peer review and expert feedback. This included a twelve month process of consultation which included: discussions within the team of authors; contributions to doctoral education seminars; use of the framework in practice, and meetings with academic colleagues as qualitative research methodology experts. We also socialised preliminary versions of the framework with academic peers at various conference and workshop forums. Field notes were taken throughout this process. None of these activities resulted in any major revision of our initial framework; however, they greatly helped us to refine and finalise the analysis steps and their sequence in our framework. The feedback on both the relevance and rigor aspects that we received from the audience was positive and did not show any need for major improvements of our analysis framework.

The relevance and the rigor aspects were also evaluated through the naturalistic approach after designing the framework. At this final stage, the evaluation of relevance was strictly focused on the usefulness, value and applicability of our framework for real projects, and the evaluation of rigor was focused on the reliability of the findings and that the probability of producing incorrect findings is kept as low as possible. To accomplish this, we conducted a research project in which we used a triangulation process of the findings of three focus groups with the findings of thirty individual interviews. These focus groups and individual interviews were conducted in a study which aimed to identify the factors that contribute to user persistence in solving their own IT problems. For the study, we first conducted three focus groups with the major groups of IT users (students, teaching staff and administrators) at a large New Zealand research university. After achieving theoretical saturation (i.e. no new idea or theme was identified during the last/third focus group), we analysed the focus groups data through the framework, and identified six groups and their sub-groups of persistence factors, among which the 'quality of joint-recovery' group was identified through the analysis of verbal interaction data, and the rest of groups were identified through the analysis of verbal and non-verbal content data. Next, we conducted thirty individual interviews (i.e. a different data collection method) with different IT users at the university. After achieving the theoretical saturation, we started analysing the individual interviews with the highest possible level of scrutiny to identify any persistence factor that might have not been identified through the focus groups. Although 'quality of joint-recovery' was identified through the analysis of individual interviews, this analysis did not lead to the identification of any sub-group within this group, due to the limitation of using individual interviews as a method for collecting interaction data.

Overall, this triangulation process of the findings did not lead to identifying any new persistence factor and did not lead to any new group or sub-group of the factors. This made us confident about both the relevance and the rigor of our focus group analysis framework. In addition, we introduced our framework to a small group of Information Systems PhD students at the authors' university and asked them to use our framework in their analysis phase of their projects. The follow up short meeting with each student showed a highly desirable perception of applicability, usefulness, ease of learning and ease of use of the framework.

3.4 THE ANALYSIS FRAMEWORK

In this section we explain each of the seven steps of our focus group analysis framework (Table 3.2), accompanied by examples and tables illustrating the practical use of the framework.

3.4.1 Determining and Organising Theoretical Sensitive Data

IS researchers usually determine the type of data they need at the early stages of their projects, typically in the design phase of their research. However, such data is usually determined as being one or more of the big groups of qualitative and quantitative types of data based on the overall research approach (e.g. qualitative, quantitative, mixed method, design science, etc.). In addition, IS researchers frequently gain new ideas and insights toward their research phenomena as the research process goes on; therefore, they may need to re-check and justify the theoretical sensitive types of data during the entire research process. Determining, justifying and organising the specific types of theoretical sensitive focus group data (e.g. verbal and non-verbal content and interaction data) is usually performed in the data analysis phase and as the first step of focus group data analysis. Due to the variety of topics and formulation of research questions in the IS research, it is unwise to be too prescriptive as to what focus group data, at what level of precision should be included in the analysis. This will be contingent on the research question. The decision to determine the theoretical sensitive data and the appropriate level of analysis should be made based on the relevant data to the research topic and the level of their contribution to the research questions (i.e. the concept of theoretical sensitivity) (Duggleby, 2005; Nili et al., 2014).

For example, if detailed non-verbal content or interaction data does not contribute to answering the research questions, they are not required to be analysed with a high level of precision. Many focus groups act as a sort of ‘group interview’, where it is expected that the participants will stimulate discussion, but the individual, rather than the group, is the unit of analysis. A researcher may not need to consider detailed non-verbal interaction data for the studies that investigate how an IT user persists in solving an IT problem (as in our example), or the qualities a user expects in an employee portal. For these purposes, non-experts can accurately interpret the meaning of most non-verbal communications to the level required by the research problem. A study where the unit of analysis is a group (for example, one examining the contribution of learning technology to group

learning processes) might require more detailed attention to the non-verbal interactions of the group. As a minimum, the researchers should transcribe and analyse readily understandable non-verbal content and interaction data that contributes to answering the research questions, and is significant enough that if it is disregarded, it can cause misunderstanding or may change the meaning of the data. Hycner (1985, p. 285) advises: "(like verbal data) non-verbal and paralinguistic cues which significantly seem to emphasise or alter the literal meaning of the words should also be taken into account". However, the analyst should justify the decision for the level of precision that is decided on, to convince readers that appropriate attention was paid to all types of data. This decision and justification at the start of the analysis is even more important when the data is analysed by multiple analysts for the same study, to ensure consistency and the ability to evaluate inter-rater reliability.

After deciding what types of data and with what level of precision they should be considered and analysed, a rigorous analysis of these data requires an efficient way of data organisation. In the following, we suggest a format that helps efficient organisation of all types of relevant verbal and non-verbal focus group data provided by the participants. Our data organisation format is extensible and can accommodate additional, more specialised annotations and coding of non-verbal data if required.

Unlike some existing guidelines (e.g. Onwuegbuzie et al.'s (2010) matrix) which suggest a separate organisation of non-verbal data, we strongly suggest that non-verbal data (both non-verbal content and interaction data) should be considered in tandem with the associated verbal data (if exists). This is because firstly there may be situations where the meaning of verbal data may be misunderstood if the analyst does not report the verbal and non-verbal data together. Secondly, although in many situations non-verbal data by themselves may be meaningful (e.g. moving head down showing agreement with an idea), there may be situations where they are meaningless by themselves. For example, the non-verbal movement of hands aiming to show belief would not be significant without matching that movement to the verbal conversation.

Also, we suggest considering and reporting the non-verbal *behaviour* such as the act of 'smile to participant x' (and as mentioned, with its associated verbal data, if any), rather than just 'happy' or

any basic emotion like the ones suggested by Ekman (1972). For example, it is too simplistic to consider a participant's smile (to another participant while expressing his or her own idea) as 'happy' in a focus group environment, as this smile may mean differently in different situations and with different verbal data. For example, it may mean a supportive behaviour like encouraging the participant to continue expressing that idea, or a discouraging behaviour such as expressing the belief that there is no value in that participant's idea. Also, in this example, the 'happy' emotion is not of a significant value to help identify any theme through this interaction. In fact, it is the act of 'smile' in this interaction (the example mentioned) that may help to identify a theme such as 'peer support'.

Figure 3.1 represents our suggested format to help organise all types of data (verbal and non-verbal content and interaction data) gained through a focus group. In this figure, the vertical column presents the number of members who provided any type of data and the moderator of the focus group, and the cells of each horizontal row present all types of data provided by each participant and the moderator when he or she asks a question, etc. In this format, all data is organised by time points members express their opinions. Therefore, in addition to the verbal and non-verbal content data, this format of data organisation can efficiently present the verbal and non-verbal interaction (flow of interaction data) between interacting participants. However, as understanding whether an interaction is taking place and which members have been interacting with each other may be difficult for people other than analyst, we suggest that analysts should clarify which members have been interacting (e.g. through a symbol, writing "in response to participant x", etc.) in the related cells of the figure. We note that if two or more cells within a column include data, this means that these data have been provided by those participants interacting at the same time.

Organising the data can be performed through spreadsheets, too, as they are easy means of organising large amount of data. However, if a table or spreadsheets are used, the analyst should clearly notify other members of the research team that the cells within the rows present the data based on time. We note that some cells of the figure may include no data, one or more types of data (e.g. verbal and non-verbal data). Also, for the non-verbal type of data provided by each participant, the analyst may prefer to add a description of it (its type and meaning) in its related cell.

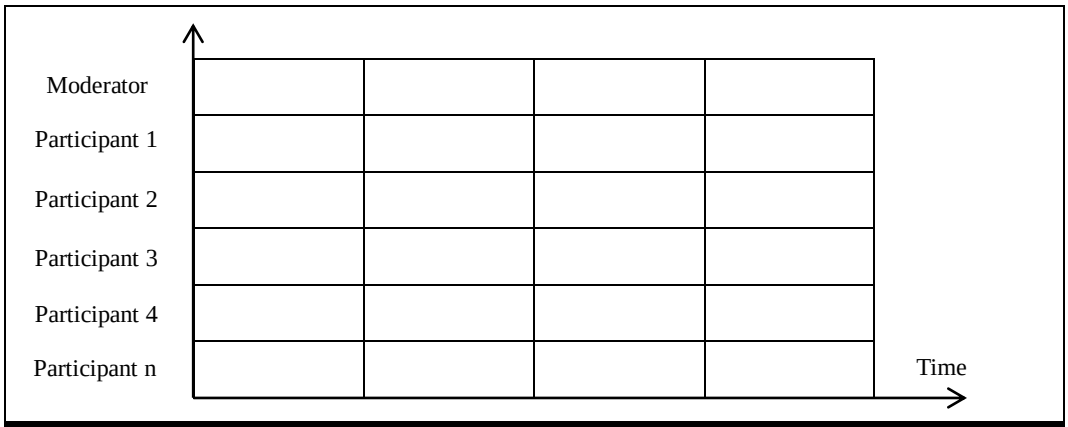

Figure 3.1: A Format for Organising Focus Group Date

Appendix 3.2 presents a part of the organised data (four participants' comments within a long discussion among seven participants) obtained through a focus group with IT users at a university. The example is a relatively typical IS research question, which examines the research question "what factors contribute to user persistence with IT problem-solving". The focus group method was chosen to help stimulate participants recall their experiences and strategies of solving the problem; to encourage each participant to elaborate on his or her experience; and to identify factors that seem to be common to multiple participants. We remind readers that in the table (appendix 3.2), the data has been organised by time; therefore, the data in the cells of the fifth and sixth columns were obtained through the participants interacting at the same time. Examples of some specialised non-verbal data are also presented.

3.4.2 Identification of Content Areas

In this step the analyst needs to read through the entire focus group transcript (or data organisation table) at least twice to gain a sense of the whole and identify content areas (parts of the text such as paragraphs or sentences each of which is about a similar concept, issue, etc. and are directly related to each other). We suggest that after identification of content areas, all related text and non-verbal data should be extracted from the transcript and video records and merged. This may lead to the identification of several content areas presented separately, thus making the next phases of the analysis process easier for the analyst.

For example, after several times reviewing the transcripts and video records of our example focus group, we identified six content areas including: technology characteristics (e.g. sentences and paragraphs about the interactivity, ease of use, etc.); personal beliefs (e.g. technology self-efficacy and perceived control on solving the technology problem); quality of self-help information (e.g. sentences about the importance of up to date online instructions); situational factors (e.g. the availability and quality of online community of users); the final outcome (e.g., importance of achieving a satisfactory outcome); and users' perceived resources cost (e.g. time, effort and money) of solving their IT problems. We note that the less structured the focus group protocol the more engagement this step requires from the analyst.

3.4.3 Manifest Analysis of Content Data

After identifying the content areas, of the next step is to analyse the manifest content for each content area separately. Below are our suggested steps for this phase of the analysis process.

- The meaning units within the manifest content of each content area should be identified and be condensed into a description close to its original text (wording of that meaning unit).
- Each of these condensed meaning units should be named/labelled with a code. We suggest writing these codes on a page/spreadsheet.
- Based on the similarities between these codes, they should be sorted into subcategories which themselves should be sorted (further abstracted) into categories. Each of the subcategories should be labelled with a name that represents its contents. Similarly, each category should be labelled with a name that represents its sub-categories. We note that this process of categorisation may need several iterations.
- The overall interpretation of the underlying meaning of all categories within each content area should be expressed via one theme.

  Lastly, we suggest reporting the results of the previous steps (how data is linked with the codes, categories and the theme within each content area) through a table. See Table 3.3 for an example of this presentation.

Table 3.3: An Example of the Format for Presentation of the Manifest Content Analysis within a Content Area								
Theme (the overall interpretation of all categories in the content area)								
Category 1			Category 2				Category 3	
			Sub-category 1		Sub-category 2			
Code 1	Code 2	Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9
CMU 1	CMU 2	CMU 3	CMU 4	CMU 5	CMU 6	CMU 7	CMU 8	CMU 9
MU 1	MU 2	MU 3	MU 4	MU 5	MU 6	MU 7	MU 8	MU 9
MU = Meaning Unit ; CMU = Condensed Meaning Unit								

For the same focus group example, Table 3.4 presents how we analysed the manifest content of the content area about quality of self-help information.

Table 3.4: An Example of Presenting the Results of Manifest Content Analysis within a Content Area							
Theme: Self-Help Information Quality							
Category 1: Obtainability			Category 2: Usefulness			Category 3: Presentation	
Code 1: Availability	Code 2: Accessibility	Code 3: Easiness	Code 4: Timeliness	Code 5: Relevancy	Code 6: Completeness	Code 7: Conciseness	Code 8: Consistency
There is information in the discussion forum.	Different sorts of information are accessible.	Finding information via Google is easier than searching in the manuals	All the solution is for version 9 not for the latest version.	The information found via the search function is not always relevant.	The information on the screen is not complete.	There is so much information (more than what is needed).	There is different Information (on a problem) in different instructions.
"I see some people like you had talked about it in another forum and the discussion is there."	"… I have access to different sorts of information online so I try to use them to fix it myself. Only when I don't know what to do, I ask a professional."	"I have found out that Google can find things in a manual of a software easier than when you search in the manual."	"I Googled first for the solution because they have a group, but all the solution is for version 9, not for the latest one…"	"If I put something in the search function, (it) is likely that similar words will be found but are not necessarily relevant."	"The (message on the screen) says I have to re-enter a password, but doesn't say what type of password."	"So much information, even though you try to be specific and use specific keywords. I ask, I just tend to ask a human being, how to do that"	"For one problem, you have got different information in different instructions."

3.4.4 Latent Analysis of Content Data

After analysis of the manifest content, we suggest analysis of the latent content data through the following steps.

- The meaning units within the latent content of each content area should be identified and be condensed into a description close to its original text.
- The interpretation of each of these condensed meaning units should be written concisely.
- Based on the similarities between these condensed meaning units, they should be abstracted into one or more subthemes with relevant headings/labels (i.e. the first step of data abstraction).
- Further abstraction of these subthemes by grouping them into one or more themes. We note that dependent on the contents of these themes, the label of one of these themes may be different or the same with the theme emerged in the previous phase.
- Lastly, we suggest reporting the results of the previous steps (how data is linked with the sub-themes and the theme within each content area) through a table. See Table 3.5 for an example of this presentation.

Table 3.5: An Example of the Format for Presentation of Latent Content Analysis within a Content Area

Theme 1				Theme 2 (=Subtheme 3)	Theme *n*	
Sub-theme 1		Sub-theme 2			Sub-theme *k*	
interpretation of CMU 1	interpretation of CMU 2	interpretation of CMU 3	interpretation of CMU 4	interpretation of CMU 5	interpretation of CMU *x*	interpretation of CMU *y*
CMU 1 close to text	CMU 2 close to text	CMU 3 close to text	CMU 4 close to text	CMU 5 close to text	CMU *x* close to text	CMU *y* close to text
MU 1	MU 2	MU 3	MU 4	MU 5	MU *x*	MU *y*

For our example of focus group already mentioned, Table 3.6 presents how we analysed latent content of the content area about quality of self-help information.

Table 3.6: An Example of Presenting the Results of Latent Content Analysis within a Content Area					
Theme: Self-Help Information Quality					
Subtheme 1 Easiness (of obtaining information)		Subtheme 2: Contextualisation	Subtheme 3: Understandability		Subtheme 4: Believability
Companies can make obtaining information easier for users.	Obtaining required information is not easy.	Information is not provided based on related context.	Some messages are not understandable for every user.	Some information cannot be easily understood by every user.	Information provided by experts is believable.
Companies can provide specific information on specific products that can be obtained easily.	To obtain required information, you have to find a way and make lots of effort.	Relevant information cannot be found efficiently, as information have not been sorted based on related contexts.	I could not understand the message (from system), as it was very unusual and unclear.		You can always go back to a website which provides credible and expert opinion.
"If certain companies had like their own websites where they said, okay product A, if issues here then lookup this link and product B, lookup that link ..."	"You will have to go and find out what they are and sort it out yourself. And I was just thinking how bad. How the heck I am going to do that?"	"It comes up with a search function; what's your problem? you type in the keywords, 'there is nothing that matches these keywords'…you just put in 'I have a problem' and it gives numerous answers."	"I could not discover (the message). It was very odd and unclear. It was my first time experiencing (it)."	"…it sends you messages and you don't know what they mean."	"… a website where you think, Okay, those people have an idea what they talk about. You can always go back to that website and refer to it…"

3.4.5 Analysis of Interaction Data

After the manifest and latent analysis of content data, the analysis of interaction data (verbal interaction data and also if necessary, non-verbal interaction data) begins. Like the verbal and non-verbal manifest and latent content data, both verbal and non-verbal interaction data can be viewed and obtained through the data organisation table. We suggest that interaction data should be analysed for two purposes: to identify points of agreement or disagreement with ideas expressed during discussions; and to interpret the meaning of participants' interactions which are beyond agreement or disagreement. The latter may also help to identify a new theme.

For the first purpose, we suggest looking at the data organisation table and identifying how many participants agreed or disagreed (verbally or non-verbally) with a participant's idea. However, we note that focus groups do not aim to empirically (not theoretically) generalise findings because as

Sim (1998) states consensus is more about "consensus across groups in terms of the range of issues concerned" (p. 349) rather than within each focus group. Reporting the strength of each agreement or dissent (e.g. strongly, medium, weakly) can also provide more insightful data, but it is not necessary because "the apparent strength of opinion is context-specific, and does not necessarily represent some stable underlying intensity of feeling" (Sim, 1998, p. 349). However, consideration of these details and a brief discussion of them (e.g. in the discussion section of a research paper) can provide a deeper insight about the topic of research and trustworthiness of its results.

For example, a participant's idea in our example focus group (with seven participants) through which we identified code 'perceived cost' of solving problems with work related IT, two participants agreed with this participant verbally and strongly, three participants agreed non-verbally (among which two participants agreed strongly), and one participant disagreed non-verbally and weekly. As most participants agreed with this code, we believe that more attention (e.g. from managers of the organisation under study) should be paid toward user's perceived cost of solving the problem and how this cost can be reduced.

For the second purpose of interaction analysis (i.e. interpreting the meaning of two or more participants' interactions), we suggest using our categorisation (of the meanings/interpretations) of participants interactions (Table 3.7). We have used Rothwell's (2010) categories of small group interactions, have added 'challenge' and 'reference' categories of interaction, and have considered 'criticism' as a separate interaction category from 'fight' interaction category (which includes criticism in Rothwell's study). The table also presents some examples and a specific definition for each of the categories. By 'reference' we mean using or mentioning sources, such as prior research and TV shows as evidence or to support one's own comment while interactions with other participants. By 'challenge' we mean any participant's expression or behaviour (e.g. asking a challenging question or asking other participants to imagine a challenging situation) that challenges other participants' minds, thus challenge type of interaction is different from criticism and argumentative behaviours.

As an example, using the data organisation table (appendix 3.2 for the content area in our focus group example), one participant commented "not sure, (the system) is the source of error or

something I have done in the past.". In response to this participant, another participant mentioned "well, I teach Human Computer Interaction. The problem is not me" while his arms were folded. Therefore, considering such 'counter dependency' expression and the various 'dependency' and 'pairing' expressions and/or behaviours (e.g. facial expressions showing supportive behaviour), analyst can consider the theme 'peer support' or support the validity of this theme if it has been already identified through analysis of content data.

Table 3.7: Types of Group Interaction

Types of Interaction	**Definition**	**Examples of Common Areas of IS Studies**
Criticism	Disapproving something (e.g. disapproval of an idea or opinion) or someone on the basis of perceived faults or mistakes and judgment	Studies of organisational behaviour, resistance to change, negotiation and collaborative work through interactive media, and conflict in small project group and internal staff context.
Fight	Argumentativeness, agitation, aggression or hostility	
Challenge	Inviting to engage in a debate, competition or argument about the truth of something.	
Flight	Evasion, an irrelevant expression, or showing isolation	
Flight-pairing	Nonintimate (not willing to disclose information), or an irrelevant or avoidant expression	
Dependency	Compliance, reliance or showing desire for direction	Outsourcing relationships and leadership style for IS management
Counterdependency	Showing rejection or independency from the authority/ leadership in the group	
Pairing	Showing intimacy, friendship, desire for help or support	Studies on social networks, social media, online reviews and group purchase behaviour
Counterpairing	Avoiding intimacy and revealing personal information	
Reference	Using or mentioning the source of information to support one's opinion or idea	

We are unable to provide specific IS examples of how these techniques have been used, as one of the contributions of our paper is to offer new opportunities for theory building based on analysis of focus group data. However, we offer some examples to show how this analysis might be relevant to IS research topics. The paper by Furneaux and Wade (2011) investigated organisational level system discontinuance intentions. An organisation or workgroup unit of analysis is well placed for focus group study. The initial framework developed by Furneuax and Wade (2011) was developed qualitatively using semi-structured interviews, but they note that "it would have been possible [to use] focus groups" (p. 580). If we go on to consider the models presented in this paper and imagine these topics being discussed in a focus group context, we can see that detailed discussion of

concepts such as institutional pressures and system embeddedness that relate to organisational politics might easily have yielded 'fight' or 'flight' behaviours in a focus group context if there was disagreement about which course of action to take. Topics such as system capability short-comings might have shown 'pairing' behaviours between two or more system advocates two or more critics in a focus group, if there were factions supporting change and factions supporting the status quo.

3.4.6 Integration of the Results within Each Content Area

In this phase of the analysis, all subcategories and categories (from the manifest content analysis) and all subthemes and themes (from the latent content analysis) within each content area are integrated together into 'subgroups' and 'groups' for that content area. The aim is to capture the overall results of data analysis for that content area. To report the result of this integration, in addition to a text that explains the results of this phase, we suggest using a table or a figure to present the results.

For example, Table 3.8 illustrates the results of this integration phase for the content area related to the quality of self-help information.

Table 3.8: An Example of Presenting the Results of the Last Step of Focus Group Data Analysis Framework

Group: Self-Help Information Quality										
Subgroup 1: Obtainability			Subgroup 2: Usefulness			Subgroup 3: Presentation			Subgroup 4: Other	
Availability	Accessibility	Easiness	Timeliness	Relevancy	Completeness	Conciseness	Consistency	Contextualisation	Understandability	Believability

3.4.7 Integration and Reporting the Results of All Content Areas

In the final step of focus group data analysis, the results need to be reported and presented in an integrated way. Therefore, all groups and subgroups of all content areas should be presented in a

short text and/or through an illustration that presents the summary of the whole results. For such illustration we suggest drawing a table, as it is consistent with the previous steps which used tables and because tables allow presenting the results in an efficient and easy to understand way. In this case, however, if space of the research document does not allow for the presentation of all content areas in a table, we suggest illustration of the results through a figure instead, as figures can incorporate and present information in an integrated way.

A solid representation of the process and results of the focus group data analysis can provide a convincing presentation for those readers who seek a rigorous and trustworthy analysis and also to those readers who simply seek an overview of the analysis process and the results. Previous methodology literature (e.g. Glitz et al., 2001; Grønkjær et al., 2011, and O'hEocha et al., 2012) and our experience show that complete focus group transcripts and complete presentation of its analysis are typically complex and lengthy – even more so when non-verbal data is added. In addition to presenting an approach for analysing focus group data, our framework presents a set of examples of how excerpts from focus group data can be succinctly and effectively presented. Researchers are urged to describe their analysis procedures and decisions (including the theoretical sensitivity of non-verbal data). Then, selected excerpts can be presented using the framework and table formats we recommended.

3.5 RECOMMENDATIONS FOR IMPROVING THE TRUSTWORTHINESS OF FOCUS GROUP DATA ANALYSIS

As with qualitative research in general, the three measures of trustworthiness in research employing focus group method include: credibility (i.e. confidence in how well data and processes of analysis address the intended focus); transferability (i.e. the extent to which the findings of research enable other researchers to follow the process of the inquiry and transfer findings to other settings); and dependability (i.e. the degree to which changes and alterations are made in the analyst's decisions during data analysis). Achieving each of these dimensions is dependent on the whole data collection process and analysis procedure. Focusing on the qualitative analysis of focus groups, in order to achieve credibility we suggest: selecting meaning units which are not too broad or too narrow; clear explanation of the condensation and abstraction process; presenting quotations

which show participants interaction while discussing a topic (see the data organisation table and appendix 3.2); showing representative quotations from transcripts in each of our suggested tables; and seeking agreement among research team and focus group participants to show how well categories and themes were identified (i.e. to ensure no relevant data has been excluded and no irrelevant data has been included in the condensation and abstraction process) (Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Myers, 2013; Sim, 1998).

Dependability can be attained through frequent open dialogues within the research team (Graneheim and Lundman, 2004; Nili et al., 2014). Therefore, if there is more than one data analyst within the research team (especially when data is collected over time through multiple focus groups), step by step comparison of the results of each analysis step can improve dependability as it can minimise divergence in analysts' judgments about similarities and differences of data when identifying codes, categories and themes. Presentation of the results of each step within our suggested process (through the tables and/or figures explained) can facilitate open discussion among analysts and the research team overall.

Like the other two dimensions of trustworthiness, transferability can be achieved thorough giving a clear description of the focus group data analysis process (Graneheim and Lundman, 2004; Nili et al., 2014), and not just a rich presentation of the final findings. Therefore, although a clear presentation and report of the final results of the focus group data analysis is of vital importance, a clear and vigorous explanation and presentation of each step of focus group data analysis plays a significant role in achieving transferability.

In general, trustworthiness of focus group data analysis is highly dependent on the extent to which presentation of the analysis process and results are clear enough to allow for alternative interpretations by readers (Graneheim and Lundman, 2004; Krueger and Casey, 2009; Moretti et al., 2011). Our suggested systematic analysis process along with tables presented in the previous sections can present a transparent and clear analysis process that help increase trustworthiness of focus group data analysis and the research results.-

3.6 CONCLUSION

In this paper, we explained how the focus of information systems research on the interactions between people and technology motivated the development of a focus group analysis framework which is *sufficiently* sensitive to capture rich non-verbal data and interactions between individuals, *without* involving the specialised psychological analysis required for research which would usually fall outside our disciplinary boundaries. At the same time, we contribute to the growing trend of providing appropriate and focused methodological sources within the IS discipline rather than relying on reference disciplines for methodological guidance. We also hope that richer and more sophisticated guidelines can support the collection and analysis of novel and rich focus group datasets, which can support interesting theoretical insights and solutions to business problems.

Among the extant research approaches and methods, qualitative data *analysis* methods have been frequently challenged by social science and IS researchers to be unsystematic and ambiguous in the process. Concerns regarding qualitative data analysis process become even more critical when it comes to the analysis of focus groups. Focus groups can provide different types of data (e.g. group level verbal and non-verbal content and interaction data) which show the higher levels of complexity, and the corresponding demand for systematic, clear and rich analysis guidelines. We explained that a significant part of IS research aims to study people as a part of system and can benefit from research data related to the interaction of individuals. For such research, focus groups can provide useful and relevant type of data that cannot be obtained through any other method. At the same time, this shows the importance of having a clear and systematic focus group data analysis framework in hand for IS researchers.

In this paper we suggested a seven step systematic and integrative framework for qualitative analysis of different types of focus group data for IS researchers. We also explained how we evaluated (through presentations, discussions with experts, triangulation of findings in an actual empirical study, etc.) and ensured the relevance (usefulness and applicability), rigor and value (ease of learning and use, etc.) of our framework both during and after its design. The robustness of our framework can be further tested by future research in various IS topics, especially by those studies in which interaction data is of theoretical sensitive importance. However, as there is little

methodological literature and guidelines on focus group data analysis in different disciplines (e.g. different management fields, health care and education) the framework we arrived at may be useful for researchers in other social science and business disciplines as well.

We note that each project with qualitative approach of data analysis can be unique and the level of theoretical sensitivity, and data abstraction and integration can vary from project to project. So, it should not be surprising if we see that even with a clear focus group analysis procedure in hand, a rigorous analysis of focus group data is not an easy job – a factor that can contribute to the challenge and enjoyment of analysing focus group data.

3.7 REFERENCES

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APPENDIX 3.1: Frequently Used Concepts in Focus Group Data Analysis

Frequently Used Concepts in Focus Group Data Analysis	
Concept	**Definition**
Content Area	A content area is parts of the text such as paragraphs or sentences each of which is about a similar concept, issue, etc. and are directly related to each other. In the literature, a content area has also been called a domain, rough structure or a cluster (Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Nili et al., 2014).
Manifest Content	Parts (sentences, paragraphs, etc.) of the transcript and observation field notes where the meaning is clear (there is no need for high level of interpretation) and are easily agreed by multiple analysts (Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Nili et al., 2014).
Latent Content	Parts of the transcript and observation field notes that need a higher level of interpretation and require more discussion among research team to understand and agree on what the text talks about (Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Nili et al., 2014).
Meaning Unit	Graneheim and Lundman's (2004 p. 106) definition (adapted in this study) of meaning unit is "words, sentences or paragraphs containing aspects related to each other through their content and context". This concept also has been called 'idea unit', 'content unit', 'coding unit' (Baxter, 1991), 'textual unit', and even 'theme' (Graneheim and Lundman, 2004; Nili et al., 2014).
Condensation	Shortening a text without changing the quality of its concept. Condensation also has been called reduction and distillation (Cavanagh, 1997; Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Nili et al., 2014).
Abstraction	The process of grouping together the condensed text on varying levels such as codes and concluding subcategories, categories and themes. Abstraction also has been called aggregation (Barrosso, 1997; Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Nili et al., 2014).
Code	A label/name, a colour or a number assigned to a condensed meaning unit (Elo and Kyngäs, 2008; Hsieh and Shannon, 2005; Nili et al., 2014). In the analysis framework of this paper, by code we mean use of labels in the analysis process.
Category	A group of similar codes and may consists of a number of subcategories. 'Category' expresses the manifest content of the transcript and answers the question 'what?' As categories are exhaustive and mutually exclusive, no data can fit into more than one category and no data must be excluded due to lack of an appropriate category (Elo and Kyngäs, 2008; Graneheim and Lundman, 2004; Hsieh and Shannon, 2005; Nili et al., 2014).
Theme	"A thread of an underlying meaning through, condensed meaning units, codes or categories, on an interpretative level" (i.e. the expression of the latent content) (Graneheim and Lundman, 2004 p. 107). A theme may include subthemes and answers the question 'how?'. As themes are not necessarily mutually exclusive, one or more condensed meaning units and even codes and categories may fit into more than one theme (Elo and Kyngäs, 2008; Nili et al., 2014).

APPENDIX 3.2: An Example of Focus Group Data Organisation

An Example of Focus Group Data Organisation						
Moderator	Do you know where the origin of the system error is?					
Participant 1				VCD: It must be my fault…my son comes (and says) "there it is mum". …I haven't seen it NVCD: The head is positioned to face down with a neutral mouth (i.e. shame)	To P5 while he is expressing his opinion: NVID: smiling (i.e. intimacy and support).	All participants: NVID: Laughing with crescent-shaped eyes (i.e. agreement with P5's comment)
Participant 2			To all participants: VID: I teach Human Computer Interaction, the problem is not me NVID: Folding arms (i.e. independency and authority).		To P5 while he is expressing his opinion: NVID: smiling (i.e. intimacy, support and agreement).	
Participant 4		To the moderator and all participants: VID: … not sure, (the system) is the source of error or something I have done in the past. NVCD: Forehead scrunched up, one eyebrow raised higher than the other (i.e. uncertainty).			To P5 while he is expressing his opinion: NVID: smiling (i.e. intimacy and support).	NVID: P4 points out to the moderator through moving eyebrows (expressing her agreement with P5's comment)
Participant 5					To all participants: VID: …It is somewhere in the middle where I say how much of this is my fault and how much is the system. NVD: Hands pointing out to P2 and P1.	

P = Participant
VCD = Verbal Content Data NVCD = Non-Verbal Content Data
VID = Verbal Interaction Data NVID = Non-Verbal Interaction Data

Chapter 4

USER PERSISTENCE IN SOLVING THEIR OWN IT PROBLEMS

Abstract: Information Technology (IT) is increasingly essential in daily life, and people depend on IT products and services to accomplish a wide range of daily tasks. Inevitably, problems with using IT do occur, due to technical reasons, service staff mistakes, or the users' own errors or misunderstanding. From the user's perspective, there is often little specific guidance in relation to the IT problem and no obvious way to solve it. The process of solving the problem may extend over a considerable period of time and may include multiple means of problem recovery, including the user's own efforts, contacting user support staff, and asking for help from other users. The trend by organizations to increasingly limit direct interaction with customer service staff; rather providing more self-help information for the users (to reduce costs and manage problem resolution more efficiently); emphasises the increasing importance of user persistence in solving their IT problems. In response to Benbasat and Barki's (2007, p. 215) call for an expanded behavioural view of "what users do in and around the notion of system use" (i.e. user's IS use-related behaviours), to date, all IS studies in this area which have an individual-level post-adoptive behavioural view have considered user's behaviours in one of the two situations, including (1) where there is an IT event/interruption which is either implementation/installation of a new IT or a significant change made to an existing IT by an organisation (e.g. the studies of user coping and adaptation), or (2) in a normal situation where no IT interruption has happened yet (e.g. the studies of habitualised use of IT). Because IT problems inevitably occur for users following the implementation of an IT and users play an important role in solving them, this paper suggests that IT problems should be considered as an IT event (an IT interruption) as well and considers solving such problems as an IT post-adoptive behaviour. The study examines the notion of user persistence in the context of user IT problem solving and in the domain of individual-level IT post-adoptive behaviours. The paper makes three contributions: a conceptual clarification of user persistence in IT problem solving; identification of factors that contribute to user persistence in solving their own IT problem; and the development of two theories of persistence using a grounded approach.

Keywords: User persistence, IT problem-solving, theory, method persistence, process persistence

4.1 INTRODUCTION

As IT becomes more embedded in all aspects of everyday life, IT problems increasingly occur for users in different environments and a range of work and study situations (Forbes, 2014; Nili, Tate and Gable, 2014a). Anecdotally, IT systems frequently "fail" or do not perform as expected. Examples include system errors while uploading a file to an online application system, a mobile accounting application with a long response time, and a learning management system with navigation problems. Also anecdotally, in order to reduce costs and manage problem resolutions more efficiently, IT users are often left to their own devices to solve problems, as businesses are limiting the direct interactions with customer service staff and providing users with more self-help information (Forbes.com, 2014; Kasabov, 2010). Surprisingly, it is difficult to obtain trustworthy contemporary information about the overall reliability of computer hardware and software from a users' perspective (remembering that some issues users perceive may be a result of their own expectations or actions, or lack of understanding or training). It is also difficult to obtain information about the extent to which users are left to their own devices to resolve IT problems when they occur, or the abandonment rate where users "give up" in their attempt to use an IT product or service. Nevertheless, anecdotal evidence points to the increasing importance of user persistence in solving their own IT problems when they occur.

In broad terms, persistence is defined as a person's perseverance and continuance toward a goal despite obstacles (Tenenbaum, Lidor, Lavyan, Morrow, Tonnel and Gershgoren, 2005; Weiner, 1970) such as the person's lack of knowledge required to solve an unexpected problem or the lack of an immediately available solution to solve a complex problem. We build from this general definition of persistence to an understanding of user persistence in solving IT problems. This may extend beyond an individual's own efforts to draw on joint efforts with the wider community or user support staff. From the user's perspective, persistence in solving their own IT problem – through their own efforts, contacting user support service staff, and asking for help from other users – contributes to achieving a problem resolution (Dong, Evans and Zou, 2008; Zhu, Nakata, Sivakumar and Grewal, 2013), and from the organisation's perspective, this resolution is vital for maintaining their customer satisfaction and customer retention rates (Dabholkar and Spaid, 2012; Sousa and Voss, 2009).

Some IS researchers (e.g. Benbasat and Barki, 2007, p. 215) have called for an expanded behavioural view of IT use to capture "what users do in and around the notion of system use" (i.e. user's IS use-related behaviours). Some recent studies of individual post-adoptive behaviours include: the 'enhanced use' construct (i.e. novel ways of using IT features, such as using formerly unused IT features, features extensions and using a feature for additional tasks; Bagayogo, Lapointe and Bassellier, 2014), 'effective use' of IT ("using a system in a way that helps attain the goals for using the system"; Burton-Jones and Grange, 2012, p. 633), 'workarounds'[17] (Alter, 2014), 'user coping' and 'adaptation'[18] behaviours (Beaudry and Pinsonneault, 2005; Ortiz de Guinea and Webster, 2011; Ortiz de Guinea and Webster, 2013), and the IS use-related activities (ISURA) construct (Barki, Titah and Boffo, 2007) which considers two major groups of IS use related activities, including (1) technology interaction behaviours, including all user interactions with an IT for a purpose, such as accomplishing a business related task, and (2) adaptation behaviours, including user's creative and/or deliberate modification-oriented activities related to the use of an IT (changing its software and hardware, its functionalities and the way it operates, and business processes or his or her own tasks).

To our knowledge, all IS studies in this area have considered an individual-level IT post-adoptive behavioural view of either the situation where (1) there is a major or system-level IT event or interruption; or (2) in a normal-use situation where no IT interruption has happened yet. System level events can include the implementation of a new IT or a significant change made to existing IT by an organisation (Louis and Sutton 1991; Lyytinen and Rose 2003). For example, studies of user coping and adaptation behaviours are in this group. Researchers have also considered the way users develop "normal use" behaviours, such as studies of habitualised use of IT[19] and the studies related to the first category of Barki et al.'s (2007) IS use-related activities (the category mentioned above).

[17] A workaround is "a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals." (Alter, 2014, p. 1044).

[18] Adaptation behaviours can include various activities. For example, according to Bagayogo, Lapointe and Bassellier (2014, p. 363), "individual adaptation behaviours can include communication activities such as talking to a colleague about how to use an IT or consulting IT professionals. It may also consist of independent exploration activities that include information search behaviours such as experimenting with different ways of operating an IT or reading help manuals".

[19] In the domain of IS post-adoptive behaviours, individual's use habits are defined as "learned situational-behaviour sequences with respect to an IT application and its features that have become automatic" (Jasperson, Carter and Zmud p. 542).

Strangely, we were not able to identify any studies on user perceptions of the reliability of the IT they use regularly, but anecdotally, we note that IT systems are not famous for reliability. So assuming that: (1) perceived IT problems inevitably occur for users following the implementation of an IT, and (2) users play an important role in solving their own problems, we suggest that user-perceived IT problems should be considered as an IT event (an IT interruption) and users' behaviour in solving such problems should be considered as an IT post-adoptive behaviour. Within this area, we were surprised to find few studies on user persistence in solving their own IT problems. This important phenomenon is the focus of our study. We note that our study is independent of voluntariness use of IT and how recently the system has been implemented, as perceived IT problems may occur for users at any time following the installation of IT in both voluntary and mandatory use contexts.

Problem solving in general is the process of identifying and implementing an effective solution for a problem (Chang, D'Zurilla and Sanna, 2004; Knaeuper and Rouse, 1985; Nezu, Nezu and D'Zurilla, 2007). An effective solution is one that "satisfices" the problem solver (Chang et al., 2004; Eskin, 2013), where satisficing leads to an outcome that is considered "acceptable", rather than optimal. The problem solver ends the process of problem solving when they achieve either a satisficing result or give up solving the problem (Eskin, 2013; Feather, 1961; Heppner and Krauskopf, 1987; Kirsh, 2009; Knaeuper and Rouse, 1985). Problems are frequently categorized into two types, structured problems (which have a clear description of the situation, the set of rules and the desired result) and "wicked" problems, which are problems where the range of options and possibilities, and the information and processes necessary to solve the problem are unknowable in advance (Mason and Mitroff, 1973). From the user's perspective, IT problems are often experienced as wicked problems. There is frequently no clear description to work with, no obvious way of solving the problem, and there may be a lack of understanding as to what constitutes an effective solution. Therefore, often the overall process of solving an IT problem may be spread over a considerable period of time, and may include more than one of the popular means of problem recovery, including the user's own efforts, contacting user support service staff, and asking for help from other users. The outcome of the process of solving an IT problem is uncertain.

Sometimes users will persist for a while before giving up on solving their problem, and sometimes they find a work-around or a good enough solution that is satisfactory to them[20].

The prevalence of IT systems and services that are delivered on a partly or fully self-serve and self-help basis suggests that understanding factors that contribute to user persistence and knowing the answer to why a user decides to persist in solving their own IT problems can help businesses to design their user support services in a way that encourages user persistence, resolves the problems more efficiently and with less cost, and can help to maintain their customer satisfaction and retention rate.

The study of individuals' persistence has been of particular interest in education, social problem-solving, and psychology research (Drucker et al., 1998; Sideridis, 2007; D'Zurilla et al., 2004). In the context of persistence in solving IT problems, to date, there is no IS study that identifies the factors that contribute to user persistence in solving their own IT problem, and there is no study that explains why the user decides to persist. This paper (1) identifies the factors that contribute to user persistence in solving their own IT problem by employing a relatively new way of factor study which includes an extensive review of service literature accompanied by the open coding and axial coding steps of Grounded Theory Method; and (2) considers the identified factors and conducts the selective coding step of the grounded theory method to develop a grounded theory to explain why a user decides to persist in solving their own IT problem through a specific method (Theory of Method Persistence) and to develop a theory to explain why a user decides to persist with their overall process of solving an IT problem (Theory of Process Persistence).

In regard to the second objective, we argue that while "grand theories" of human motivation (e.g. Expectancy Theory by Vroom, 1964 and Theory of Achievement Motivation by Atkinson, 1957) and problem solving (e.g. Human Problem Solving by Newell and Simon, 1972, and Creative

[20] As an example, imagine a problem with an online registration form. To solve this problem, a user may start by using the available online instructions to solve the problem through their own efforts. If the user is not satisfied with the result, and the user refuses to give up, they may persist in solving it by asking for help from a colleague in their work environment or via an online discussion forum. If this is still unsuccessful, they may decide to ask for help by telephoning user support service staff, even if they expect this will require a long wait time. The process of persisting in solving this IT problem will end if the result is acceptable (e.g. the problem is either solved or worked-around, or has gone away) or the user withdraws from solving it. This is not to say that a similar problem will not reoccur for the user in the future, as a new instance of IT problem solving.

Problem Solving by Čančer and Mulej, 2013), and general definitions of persistence exist in other fields, none of them have both the necessary and sufficient characteristics required to explain 'user persistence' with IT problem solving. Therefore, new theoretical explanations must be developed. This grounded study falls within the general domain of theorising originally called for by Weber (1997) and by Grover and Lyytinen (2015) – a theory for a phenomenon (user persistence with IT problem-solving) that purportedly might be explained by theories from other domains (e.g. theories of motivation, decision-making and goal-seeking behaviour), but for which we will argue that a novel and IS-specific theory is required. This responds to recent calls from within the information systems discipline to depart from the standard research 'script' that frequently involves survey research and 'mid-range' theorising (Grover and Lyytinen, 2015) based on adapting grand theories from relevant disciplines (Tate, Evermann and Gable, 2015), and to develop native theories in the IS discipline.

This study answers the following research questions:

A. What are the factors that contribute to user persistence in solving their own IT problem?
B. In the event of an IT problem for a user and when the user starts to solve the problem,
   2.1. Why does the user decide to persist with a specific method of solving their IT problem?
   2.2. Why does the user decide to persist with the overall process (this may include several different methods) of solving the problem?

We make three related contributions to the understanding of user persistence in solving IT problems: a conceptual clarification of the phenomenon; identification of factors that contribute to user persistence in solving their own IT problem; and the development of original theory using a grounded approach.

The remainder of the paper is structured as follows. We first provide a conceptual clarification of user persistence with IT problem solving, explain how it is conceptually distinct from related phenomena, and why existing theories do not explain it. Next, we provide an overview of the methods, including our approach for literature review and the methods of primary data collection and analysis we employed to identify factors that contribute to user persistence and to develop our

two original theories. The paper then presents a discussion of the findings and the implications for IS research and practice. Finally, it concludes with a statement of the research limitations and suggestions for future research.

4.2 CONCEPTUAL CLARIFICATION OF USER PERSISTENCE

In this section, we (1) distinguish that user persistence in solving their own IT problem is conceptually distinct from persistence in solving other types of problems and from related concepts such as perseverance and grit; (2) explain that why existing theories cannot explain user persistence; and (3) provide a clear conceptual definition of user persistence. We employ MacKenzie, Podsakoff and Podsakoff's (2011) guidelines of construct conceptualisation to differentiate persistence from related constructs and to provide a conceptual definition of user persistence. We used Mackenzie et al.'s (2011) guidelines because of their clarity and particular focus on rigorous construct conceptualisation in information systems and behaviour research. They advocate clear specification of the conceptual domain of the focal construct, the entity to which it refers and the conceptual theme. The conceptual *domain* is defined as "the general type of property to which the focal construct refers" (pg 298). This can be a thought, a perception, an outcome or an intrinsic characteristic. The *entity* is defined as the "object to which the property applies (e.g., a person, a task, a process, a relationship, a dyad, a group/team, a network, an organization, a culture)." (pg 298). The *conceptual theme* is the necessary and sufficient attributes to define a construct (MacKenzie et al., 2011).

We first consider the difference between user persistence in solving perceived IT problems, and seemingly-related concepts such as persistence in problem-solving, perseverance and grit. In general, studies of persistence in problem-solving have focused on 1) persistence in solving a 'given' well-defined problem to a person (i.e. a structured problem which has a clear description of the situation, of a set of rules and of the desired result) such as puzzle-type problems, usually examined in experimental studies; 2) a 'given' ill-defined problem (a problem which lacks at least one of the characteristics of a well-defined problem) such as a math problem with clear description of the problem, but with no specified way of solving it; and 3) a given task (which is not necessarily a perceived problem) to a person such as a student or an employee in organisational studies. Also,

it is important to note that there are other studies of persistence (we prefer the terms perseverance or grit to distinguish between this phenomenon and persistence) that have focussed not on *solving perceived problems*, but on *achieving long term goals*, such as attaining a college degree or selection for an elite sport team. We clarify that the differences between the concept of user persistence with IT problem solving and persistence in the extant literature particularly relates to the conceptual theme (i.e. the necessary and sufficient attributes to define a construct). These differences include (1) the size and time-scale of the problem to be solved (we reserve 'persistence' for short-to-medium term problem-solving, and suggest that 'perseverance' or 'grit' are more appropriate terms for persistence towards long term life-goals), and (2) the nature of the problem (which is technology-focused, and frequently, from the user perspective, perceived as 'wicked', unlike the property of persistence in solving other types of problems such puzzle or math problems).

When deciding to perform a behaviour (e.g. persisting in solving a problem), an individual considers what he or she stands to gain (e.g. a resolved problem and/or a reward) or lose (i.e. the opportunity-cost of solving the problem, such as time that can be dedicated to solving another problem or to performing another task). This mental process of weighing expected outcomes and choosing one option over others is the focus of some theories of human motivation, including Theory of Achievement Motivation (Atkinson, 1957) which considers the role of individual's risk taking behaviour, and Achievement Goal Theory (Dweck, 1986; Dweck and Leggett, 1988) which mainly focuses on change in an individual's efficacy and achievement motivation during a task due to such things as change in the task difficulty. The concepts of motivation and cost sacrifice in making a decision are together implicitly mentioned by the Decision Theory - a branch of statistical theory, various versions of which exist in disciplines such as economics, sociology, public health and computer science (algorithmic decision theory). It is concerned with problem-solving under uncertainty, and results in a rational decision (the most possible advantageous course of action) through identifying and weighing values and issues such as conditions of uncertainty. These theories clearly show the 'decision' nature of user persistence phenomenon; however, none of them include persistence as a focal construct. In addition, none of their focal constructs possess the attribute of being a user who intends to do a behaviour in relation to their IT usage, and the primary purpose of none of them allow them to be likely to explain the user's behaviour after their 'first

click' when solving an IT problem. Therefore, none of these theories can directly help to conceptually define user persistence.

We believe that as the overall process of solving an IT problem frequently includes at least two methods of attempting to solve the problem, separate definitions must be considered for persistence with a method of solving the problem and persistence with the overall process (the entire collective methods) of solving the problem. We define 'method persistence' as a user's (person as the entity) decision to continue to pursue a goal (general property) using the same method when confronted with a perceived obstacle (conceptual theme). We define 'process persistence' as a user's (entity) decision to continue to pursue a goal (general property) using any combination of possible methods of solving the problem when confronted with perceived obstacles (conceptual theme). We note that factors such as 'time' and 'effort' are not necessary to the definition of persistence, rather they are used to measure the level of persistence (e.g. a high or low persistence).

4.3 METHOD

In this section we provide an overview of the steps we took and the methods we employed to identify the factors that contribute to user persistence (research question 1) and to develop our two theories[21] of user persistence (research questions 2.1 and 2.2). Details on each of these data collection and analysis methods and the results are presented accordingly.

4.3.1 Overview of the Steps Taken to Identify Factors that Contribute to User Persistence

In order to answer the first research question, we first conducted a critical literature review and analysis to identify factors that 'might' contribute to user persistence; thus, creating a list of

[21] Baesd on Steinfeld and Fulk (1990), Bhattacherjee (2012, p. 29) recommend that there are four approaches to theory building, including (1) "[an inductive] bottom-up conceptual analysis to identify different sets of predictors relevant to the phenomenon of interest using a predefined framework"; (2) "[a deductive approach] to extend or modify existing theories to explain a new context, such as by extending theories of individual learning to explain organizational learning"; (3) "to apply existing theories in entirely new contexts by drawing upon the structural similarities between the two contexts"; and (4) the "grounded theory building" approach to build theories inductively, grounded in empirical data and based on patterns of events or behaviours. As explained, none of the existing theories and frameworks fits well to the topic of this paper and none of them can fully explain the user persistence phenomenon. Therefore, the grounded theory method was chosen for this study. The method is a flexible (though systematic) method of theorising (Glaser, 1978, 1998) and there have been calls for innovative use of the method for grounded theory development by IS community (e.g. JAIS call for papers on Advances in Qualitative IS Research Methodologies, 2016).

candidate persistence factors. This was followed by the first step (open coding step) of the grounded theory approach (Strauss and Corbin, 1990, 1998) to modify (add, remove or revise the label/name of some factor) and confirm the factors in the list and then, followed by the second step of the approach (axial coding step) to categorise them into groups and sub-groups. The open coding step involved a simultaneous process of primary data collection and initial analysis of data which was obtained through three focus groups with IT users (see the rest of the section for details on the focus groups and how we conducted them through the critical incident technique). The axial coding step involved sorting the factors into groups and sub-groups (the purpose of employing the axial coding step to help answering this research question) and identifying the general relationships between the groups to help explain the persistence phenomenon (the results of this part of the axial coding step was later considered in the third step of the grounded theory approach to develop theory). Our decision to conduct a critical literature review before conducting the open and axial coding steps was because user behaviour and decision making have been widely studied (though not specifically on the topic of this research) in the fields of information systems, service management and psychology. Therefore, it was clear that a number of persistence factors might be identified from these bodies of literature, or at least that the literature could help us in efficiently naming/labelling the factors identified in the first step of our primary data analysis (Bhattacherjee, 2012, p. 114), and thus increase the quality and validity of our findings.

Our use of the list of candidate factors is similar to the template coding idea suggested by King (1998), which has been used in tandem with the grounded theory approach in several theory building studies, such as Maznevski and Chudoba (2000), Faraj, Kwon and Watts (2004), Tanudidjaja, Kankanhalli and Tan (2003) and Vaidya and Seetharaman (2011). We were expecting that some of the factors in the list may need to be relabelled or may not be supported by data. Also, we were open to any new persistence factor that may emerge during our data analysis. Our being open to these changes, and to any emerging persistence factor, was supported through our choices of primary data collection methods.

We chose the Critical Incident Technique (Flanagan, 1954) as our primary data collection technique. Critical incident technique is a popular technique in health research, marketing and organisational behaviour studies, and is used for the purpose of identifying very effective and very

ineffective contributing factors to a result. In this method, the researcher asks participants to recall the events (or incidents) related to the topic of a research project (e.g. IT problem events that has occurred for a user during the last six months before their participation in the research), how these events were handled (e.g. what the user did to solve the problem), and the contributing factors to the handling of the event (e.g. what IT quality factors or user support performance quality factors contributed to a satisfactory or unsatisfactory resolution of the problem). The events that each participant recalls are usually the significant (or critical) events, and the contributing factors to the handling of these significant events are the 'very' effective or 'very' ineffective factors. In studies of human behaviour, the overall purpose of the technique is identifying these factors (Flanagan, 1954; Schluter, Seaton and Chaboyer, 2008); therefore, the data collection process ends when the researcher does not identify any new factor, theme or idea (i.e., when the researcher reaches theoretical saturation).

In the event of an IT problem, the overall process (the collective methods) of solving the problem may be spread over a considerable period of time. The technique allows us to gather relevant data about the factors contributing to user persistence while avoiding many temporal and geographical limitations. In addition, seeking information from the users about their persistence during a period of time prior to the data collection session can help to minimise the researcher's influence on user persistence behaviour. Moreover, the persistence factors are identified through participants' explanations of each significant event; therefore, the technique supported us in being open to any new, emerging persistence factors or changes (such as the relabelling or exclusion of some of the factors in the list of candidate factors).

The critical incident technique is a flexible technique that can be used with any data collection method (Flanagan, 1954; Schluter et al., 2008). In this study, the technique was used with the focus group method. Compared to survey questionnaires and individual interviews, the social and interactive nature of focus groups encourages participants to recall their experiences of significant events of IT problems and provides the opportunity for group discussion (Kitzinger, 1994; Nili et al., 2014c; Stahl, Tremblay and LeRouge, 2011) and elaboration of the factors that they believe contribute to persistence when attempting to solve their IT problems. Also, the group discussion characteristic of focus groups provides this opportunity for the participants to better clarify their

opinions (Stahl et al., 2011). These group discussions and elaborations also supported us in being open to any new emerging persistence factor and to any change (e.g. relabelling of the factors) in our list of candidate persistence factors.

In addition to our use of the critical incident technique with focus groups, we conducted another round of data collection through individual interviews. The individual interviews were conducted for the purpose of collecting more data through a different method (other than the focus group method) from different IT users (no overlap in participants between the focus groups and individual interviews) who have experienced different events of IT problems (i.e. triangulation and ensuring the reliability of the findings) to allow identification of any new persistence factor not identified through the focus groups, or any conflicting result. In addition, as it will be explained in more detail, the critical incident technique was not used for the individual interviews because we asked participants to take note of (not to recall) the events of IT problems they experienced *as they occurred* within two weeks prior the interviews and the interviews were based on those notes. Although the data collection and analysis processes were conducted in tandem, they are presented separately for the purpose of clarity and detail.

4.3.2 Overview of the Steps Taken to Develop Theory

In order to develop our two theories of user persistence (research questions 2.1 and 2.2) we built upon the findings of axial coding step and followed the third step of grounded theory approach (selective coding). This involved refining (selecting the groups of factors that contribute to user persistence the most), defining, and logically relating the factors and/or groups of factors to each other and describing what these relationships together mean to generate our theories. We note that throughout the entire data analysis, we performed a continuous, interpretive process of rearrangement, refinement, and integration of groups and the relationships between the groups (i.e. constant comparison, cf. Strauss and Corbin, 1990, 1998). In addition, we used note taking and diagrams (memoing) to keep track of, and refine, our ideas, discover relationships between the groups, and to assist in identifying larger patterns.

4.4 CANDIDATE PERSISTENCE FACTORS

Creating our list of candidate persistence factors involved three main steps: (1) identifying candidate persistence factors through reviewing related IS and post-adoptive behaviour theories to the notion of user persistence, and selecting the potentially relevant constructs of these theories to user persistence. This review was then extended to reviewing related theories in the field of psychology. Section 4.4.1 presents the mechanism and the results of this step; (2) identifying another group of candidate persistence factors through reviewing and analysing related post-adoptive user behaviour studies in IS and e-service management literature (e.g. e-service recovery literature). This review was then extended to the review of the information quality scales and system quality studies, as some of the selected papers suggested that the quality of information on problem recovery (e.g. the quality of available online instructions for users) and some system quality related factors may contribute to user persistence, but the papers themselves did not provide enough information about these factors. Section 4.4.2 explains the mechanism of this literature review and its results; and (3) synthesising and categorising the results of the previous two steps and arriving at the final and integrated list of candidate persistence factors. Section 4.4.3 presents the results of this last step.

4.4.1 Review of Behavioural IT Theories to Identify Candidate Persistence Factors

Our first step for identifying potential persistence factors was selecting IS and service management theories that are related to the notion of user persistence, and examining their constructs that may potentially contribute to user persistence[22] (i.e. identifying candidate antecedents to user persistence). We selected or excluded the theories based on whether (1) their focal constructs possess the attribute of being individual IT users (i.e., the individual IT users class of things; Weber, 2012) who intend to do a behaviour in relation to their IT usage; and (2) their primary purpose allow them to be likely to explain a user's behaviour after their "first click" when solving an IT problem. We found Behavioural-Intention (B-I) theories that are used in the studies of IS and e-service management research as the IS theories that meet our first selection criteria. We then examined each B-I theory as whether it meets our second selection criteria to see whether it may

[22] Our scanning of existing theories for constructs of possible relevance is similar to Bandara, Gable and Rosemann's (2005) approach for their study of identifying factors and measures of business process modelling.

have potential explanatory power for the context of user persistence. The selected B-I theories were then critically examined to identify their potentially relevant constructs to user persistence. Using MacKenzie et al.'s (2011) guide, a construct was considered a potential persistence factor, if it's entity is a user, its conceptual domain is a user's perception regarding the usage of an IT, and its conceptual theme allows it to be likely to explain the user's behaviour after their "first click" of solving the problem (see MacKenzie et al., 2011 for the concepts related to the conceptual definition of constructs in IS and behavioural research). We note that after identifying potentially relevant constructs of the selected B-I theories, we realised that some of these constructs are highly relevant to the aims of some motivation-based problem-solving theories in psychology literature. As a result, our review of theories was extended to the review and analysis of these theories. The rest of this section presents the results of our review of the theories related to the notion of persistence and the candidate persistence factors that were identified from this review.

Among the B-I theories, Theory of Reasoned Action (TRA: Fishbein and Ajzen, 1975) has been extensively used in IS and service management research, but we did not consider it as a related theory to the notion of user persistence, as its primary aim is to explain an individual's intention to start a behaviour (e.g. technology acceptance and the "first click" of solving an IT problem)[23]. Similarly, the Technology Acceptance Model (TAM: Davis 1986, 1989), Combined TAM and TPB (C-TAM-TPB: Taylor and Todd, 1995), Task-Technology Fit (Goodhue and Thompson, 1995), Motivational Mode (Davis, Bagozzi and Warshaw,1992) and the Unified Theory of Acceptance and Use of Technology (UTAUT: Venkatesh, Morris, Davis and Davis, 2003; Venkatesh, Thong and Xu, 2012) were not considered, as they primarily aim to explain adoption of a technology. Also, IS Continuance Theory (the Expectation-Confirmation Theory in the IS context: Bhattacherjee, 2001) was not considered, because of its explanatory focus on user intention to start next usages of an IT after the first use (and does not cover technology problems, problem solving and persistence). Among all the behavioural intention theories, the Revised Theory of Planned Behaviour (RTPB) (Ajzen, 2002) and Social Cognitive Theory (SCT) (Compeau and Higgins,

[23] Moreover, there is a significant confounding between the two main antecedents of behavioral intention, including 'attitude toward behavior' and 'subjective norms' since norms can be reframed as attitudes and vice versa. Also, the theory does not consider any limitation and constraints, such as an individual's limited ability in overcoming an unstructured problem (a second reason for not considering TRA as a candidate theory for explaining user persistence in IT problem solving). Later, the Theory of Planned Behavior (TPB) aimed to address these limitations.

1995) were selected for further analysis, as their goal and wide scope of applicability make them likely to be able to explain a user's behaviour after their "first click" in problem recovery (e.g. persistence in solving the problem).

Ajzen (1991) argues that intention toward behaviour cannot be the exclusive factor leading to the actual behaviour when the person does not have a complete perceived control over their behaviour. Therefore, the Theory of Planned Behaviour (TPB) extends the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), adding 'perceived behavioural control' to improve the predictive power. Later, Taylor and Todd (1995) proposed the Decomposed TPB, in which self-efficacy and facilitating conditions were suggested as the antecedents of perceived behavioural control. Finally, Ajzen (2002) revised the theory by breaking down perceived behavioural control into self-efficacy (the individual's assessment of their ability to organise and execute actions to manage a situation) and controllability (the extent to which an individual believes that performing the behaviour is up to them). Overall, the relevant constructs offered by RTPB are perceived behavioural control, self-efficacy, controllability and subjective norms. The subjective norms construct explains an individual's belief that they should or should not perform a behaviour because most people who are important to them think that they should or should not do it. RTPB is the latest version of TPB, has a higher explanatory power and internal consistency compared to its previous versions, and has a wide scope of applicability that allows consideration of user persistence as a continuous behaviour.

SCT is a prominent theory in human behaviour which identifies behaviour as an interaction of personal factors, behaviour and the environment, and can help to understand and predict a modification or change in an individual's behaviour (Jones, 1989). SCT was adapted for the IS field by Compeau and Higgins (1995), who examined the theory in the computer utilisation context. The theory allows for a wide application, including the study of user behaviour after the "first click" and persistence in solving an IT problem. Relevant constructs offered by the theory are "self-efficacy", "anxiety" (evoking anxious or emotional reactions when performing a behaviour) and "outcome expectations" (performance related outcome and the individual's sense of accomplishment of a task).

Next, we realised that the self-efficacy and perceived behavioural control constructs of RTPB, and the self-efficacy, outcome expectations and anxiety constructs of SCT, are highly relevant to the aims of Self-Efficacy Theory (Bandura, 1977), Attribution Theory (Weiner, 1974), Anderson's (1990) theory of rational analysis of problem solving and Coping Theory (Lazarus and Folkman, 1984). The concepts of self-efficacy and attribution are closely associated with each other. Baumgardner, Heppner and Arkin (1986) found that effective problem solvers have a higher level of self-efficacy and tend to focus on problems within their own control, and view insufficient effort (internal attribution) as a main reason for ineffective problem solving. In contrast, ineffective problems solvers tend to attribute the reason to other (external) factors such as difficulty of the problem, chance, etc. Although the concept of locus of control is relevant to the concept of self-efficacy and attribution, it mainly focuses on the individual's perceived control over the consequences of their behaviour and not the perceived control over the behaviour (e.g. persistence in solving the problem) itself. The latter is the focus of the "perceived behavioural control" construct of RTPB (Ajzen, 2002).

Anderson's (1990) theory focuses on the point in time an individual stops solving a problem through a plan among a range of possible plans to solve the problem. The theory considers the probability of achieving a goal (P) when a behaviour is enacted, the value assigned to that goal (G), and the cost that will be incurred to achieve it (C), and suggests that a rational problem solver gives up solving a problem when estimated PG-C approaches zero for all considered plans. Anderson's theory and the extant studies which have used the theory (these are experimental studies, such as Payne and Duggan, 2011) mainly focus on an individual's stopping/giving up behaviour; therefore, it cannot specifically explain why an individual decides to 'persist' with a specific method of problem solving. Moreover, the theory focuses only on one plan among a range of possible plans/methods; therefore, it cannot explain why the individual persists with the overall process (the entire collection of the methods) of solving a problem. However, this general theory is relevant to the notion of user persistence, and its constructs may contribute to user persistence in solving their own IT problem.

Coping theory - a theory that explains individuals' cognitive and behavioural responses to manage psychological stress (Lazarus and Folkman, 1984) - has been used in some recent IS studies of

post-adoptive behaviours (from Beaudry and Pinsonneault's 2005 study onwards) as an approach of studying and analysing how users deal with IT interruptions, particularly unintended ones in stressful (or anxiety) situations (Ortiz de Guinea and Webster, 2011). According to the theory, if an individual classifies an event as stressful (i.e. primary appraisal), the user then assesses the level of control they exert over the event and assess whether they can face the interruption given the coping resources (e.g. their skills and knowledge required to solve the problem or social support) available to them (i.e. secondary appraisal). As a result of this evaluation (i.e. secondary appraisal process), they might adopt an engagement coping strategy to encounter the stressor, or they may think that they cannot change the situation (i.e., they may think that they do not have the necessary resources) and they may use a disengagement/escaping strategy and give up their efforts. We believe that a user's perceived IT problem (or an IT interruption in this case) can be considered as an stressor, that anxiety (which is also mentioned in the SCT) of solving an IT problem is a negative emotion while the user is in a stressful situation of solving the problem, and that user's own knowledge, available self-help information, peer support and user support service staff can be considered as resources being assessed in the secondary appraisal stage of the coping theory. However, although the relevancy of the coping theory to the notion of user persistence is enough to consider it as a candidate theory for this study, the primary purpose of the theory is different with the purpose of our study and therefore, the theory cannot fully explain the user persistence phenomenon. In fact, the concept of user coping and the purpose of the coping theory are more relevant and useful for explaining user adaptation to an IT interruption, such as adaptation to installation of a new IT or a significant change made to an existing IT by an organisation (Beaudry and Pinsonneault, 2005). This is also a main reason mentioned by Beaudry and Alain Pinsonneault (2005, p. 494) for their conceptualisation of "user adaptation as coping".

It is also worth mentioning that Expectancy Theory (Vroom, 1964) which is an influential and prominent theory of human motivation may seemingly be relevant to the notion of user persistence, but in fact, it is not relevant enough to be considered as a candidate theory for this study. The theory explains the formation of an individual's motivation (motivational force) to perform a behaviour by its three constructs of expectancy, valence and instrumentality[24] which form two

[24] These constructs form the equation [motivational force = expectancy * valence * instrumentality]. As an example, if an employee believes that there is a value (e.g. a reward from their organisation) in a better performance (e.g. higher productivity), they make a

relationships in the heart of the theory. These relationships include effort → performance (an individual's perception that more effort leads to a required performance level) and performance → outcome (the individual's perception that this required performance level leads to a desired outcome). Therefore, the purpose and the domain of this study (i.e. explaining why a user decides to persist with solving their own IT problem) is different from the overall purpose of the expectancy theory. Here, we note that the concept of user persistence is more similar to the concept of 'effort' (not 'performance') in the expectancy theory; thus, the second relationship (which constitutes half or a significant part) of the theory is irrelevant to the user persistence phenomenon[25].

Therefore, in addition to RTPB and SCT, we considered Self-Efficacy Theory, Attribution Theory, Anderson's (1990) theory and Coping Theory, as they are relevant to the notion of persistence behaviour and are likely to explain (are likely to assist us in explaining) user persistence in solving their own IT problem. Table 4.1 presents the list of candidate persistence factors that we identified through the review of these theories. Furthermore, another comprehensive search for identifying any other related theory was conducted, this time in the broader psychology literature, but it did not identify any theory that is specifically about persistence behaviour.

higher level of 'effort' to achieve the required level of productivity which is required to achieve the reward. See DeSanctis (1983) - an experimental study of decision support systems - for a more detailed description of the theory.

[25] Moreover, as it will be discussed during presenting the *emerged* findings of our grounded study of user persistence, we identified a cost and benefit evaluation/analysis logic based on which a user decides to whether persist in solving their own IT problem. This logic led to forming our two theories of user persistence. As a result, the Expectancy Theory and our two emerged persistence theories are different in logic and structure, as well.

Table 4.1: The List of Candidate Persistence Factors Based on the Review of Related Theories		
Factor	Reference	Definition
Perceived Behavioural Control*	Ajzen (2002)	An individual's perceived control over the performance of the behaviour (i.e. an individual's perception of their ability to perform a behaviour such as using an IT, solving an IT problem, etc.).*
(Computer) Self-Efficacy	Compeau and Higgins (1995); Ajzen (2002); Bandura (1977)	Computer self-efficacy refers to individuals' judgment of their capability (in organising and executing actions) to use computers in diverse situations.
Anxiety	Compeau and Higgins (1995); Lazarus and Folkman (1984)	Evoking anxious or emotional reactions when performing a behaviour in a stressful situation.
Subjective Norm	Ajzen (2002)	An individual's perception that most people who are important to them (e.g. colleagues or friends) think that they should or should not perform the behaviour.
Attribution (internal attribution and external attribution)	Weiner (1974)	An individual may attribute an event or the reason for a problem to their own actions (internal attribution) or to external factors such as other people or technology (external attribution).
Probability **	Anderson (1990); Lazarus and Folkman (1984)	An individual's perceived probability of solving a problem
Gain	Anderson (1990)	The problem solver's perceived value of the outcome of their problem solving.
Cost	Anderson (1990)	The problem solver's perceived cost that needs to be incurred to achieve an outcome.
* 'Controllability' is covered by the concept of Perceived Behavioural Control. It has not been considered as a candidate persistence factor for the purpose of parsimoniousness of the final list of candidate factors. ** Assessing the probability (of an outcome) is also similar to an individual's evaluation in the second appraisal stage of Lazarus and Folkman's coping theory.		

4.4.2 Review of IS and Service Management Literature to Identify Candidate Persistence Factors

This step in compiling the list of candidate persistence factors started with a review of the e-service recovery studies in the information systems and e-service management literature. We searched AIS Electronic Library, ACM Digital Library, Web of Science, ProQuest Computing, ScienceDirect, Emerald and SpringerLink databases. Only journal articles (regardless of their rank) and AIS conference papers were considered. The keywords used included 'service problem', 'service failure', 'service recovery', 'service problem recovery', 'service failure recovery', 'service problem solving', 'problem recovery' and 'problem solving', and only the articles which included these keywords in their title or abstract were extracted. Among these, the papers in the area of traditional service contexts (the ones which only focus on face to face service recovery interactions and/or do not consider the usage of interactive technology-mediated service interactions between

service staff and customers) were excluded and the ones which are in the area of e-service recovery were selected for further analysis. Among the remaining papers, we excluded the service recovery papers where their main focus is on complaint handling and post recovery strategies (e.g. compensation for a service failure), as these papers are more related to the study of the effects of service recovery on user satisfaction and post-recovery behaviours (e.g. loyalty and switching behaviour). Also, the papers which focus on service-recovery from the strategic, organisational and internal business aspects (not from the user's perspective) were excluded. Forward and backward citation checks were carried out for each selected paper. This process sometimes led our search to identification of some journal papers in the psychology discipline. We found that relevant papers were already addressed in section 4.4.1. This gave us confidence that we had achieved saturation in our literature search. Overall, 14 papers remained and were considered for analysis.

The majority of the factors that are identified in these 14 papers are service staff performance quality factors, such as procedural justice/fairness, interactional justice and personalised response in recovering e-service problems (see abstract 4.1 for the definitions of these factors). In addition, system interactivity (Zhu et al. 2013) has been mentioned as an important system quality factor in recovering e-service problems, and the availability and quality of the information that are produced by businesses for users to solve a problem by their own efforts (e.g. online instructions and how-to information for a particular IT) have been mentioned as potential persistence factors by some of these papers, especially by Kasabov and Warlow (2010) and Kasabov (2010), and by some industry related articles (e.g. Nili et al., 2014a; Forbes.com, 2014). Therefore, we extended this literature review to the IS and e-service management journal and conference papers which have identified system quality factors, and to the IS and e-service management papers which provide information quality scales in the business to consumer (B2C) context. Therefore, in our review of information quality scales, we excluded the data and database quality scales (e.g. Naumann and Rolker, 2000 and Oliveira, Rodrigues and Henriques, 2005), web and data mining, scales for the context of quality of information related to internal and organisational aspects such as transaction and accounting information (e.g. Nicolaou, Ibrahim, and Heck, 2013; Nicolaou and McKnight, 2006; Price, Neiger and Shanks, 2008), scales for enterprise and knowledge management systems (e.g. Wang and Wang, 2009), and the information quality scales for the business to business and supply chain contexts (e.g. Forslund, 2007). Overall, our extension of literature review to the

system quality and information quality contexts led to identifying 15 relevant papers to the area of system quality and ten papers which have provided information quality scales in the B2C context.

As a result of the combined search process, we identified 39 papers, in addition to the 7 theory papers which were examined in section 4.4.1 (46 relevant papers overall). After reading each of these 39 papers in detail, we identified 55 factors. These factors and their definitions are presented in appendix 4.1. We then used the same criteria that we used in selection of candidate persistence factors in the previous section. This resulted in exclusion of 14 irrelevant factors at this stage. Next, we focused on the remaining factors and realised that some of them are very specific, some are identical to others in terms of their definition, some are very broad, and some have considerable overlap with some other factors in terms of their concepts. Therefore, to ensure both the parsimoniousness and completeness of the factors, we conducted a detailed content analysis of their definitions. Where some factors are the same (identical) in terms of their definitions and concept, we chose either the factor/label which best represents the concept or the one which has been used more frequently in literature (e.g. see appendix 4.1 for the reason why we selected 'understandability' of information and excluded 'interpretability' and 'ease of understanding'). Where some factors have overlap with others or are very broad, we examined them to identify the most parsimonious and inclusive one. 21 factors were excluded as a result. In addition, 2 factors including attribution of blame/failure and recovery expectancy were excluded. Attribution of blame/failure was excluded, as it had already been identified in the previous section (see Table 4.1), and recovery expectancy was excluded, as it is covered by the concept of the 'probability' factor mentioned in Table 4.1. Appendix 4.1 presents all of the excluded and remaining 55 factors we identified from the e-service recovery studies, system quality studies, and information quality scales, the definition of each and the reason for their exclusion or selection. Table 4.2 presents the list of the 18 selected persistence factors and their definitions.

Table 4.2: The Selected Persistence Factors from the e-Service Recovery Studies, System Quality Studies, and Information Quality Scales			
Type of Study	Candidate Factors	Reference	Definition
E-Service Recovery Studies	Interactivity	Zhu et al. (2013)	User's perception of how well a system responds to commands and how easily it enables arrangement of the amount, sequence and style of presented information (i.e. how well and how easily a user can interact with a system while using it). Interactivity is a system quality related factor which was identified from e-service recovery studies.
	(user's perceived amount of recovery) Effort	Zhu et al. (2013)	User's perceived level/amount of effort while they are trying to solve the problem.
	Procedural justice	Folger and Cropanzano (1998); McColl-Kennedy and Sparks (2003); Sabharwal, Soch and Kaur (2010); Robertson et al. (2012)	"Procedural justice is the perceived fairness of the process through which ends are achieved". It encourages the continuation of productive relationships (Sabharwal et al., 2010, p. 128).
	Interactional Justice	Folger and Cropanzano (1998); McColl-Kennedy and Sparks (2003); Sabharwal, Soch and Kaur (2010); Robertson et al. (2012)	"Interactional justice is the extent to which customers feel that they have been treated fairly while personally interacting with the employees of company while going through the recovery process" (Sabharwal et al., 2010, p. 129).
System Quality*	Usefulness	Moore and Benbasat (1991), You and Donahue (2001), Bhattacherjee (2001), Barnes and Vidgen (2002)	The degree to which a user believes that using the system enhances his or her job performance.
	Ease of Use	Yoo and Danthu (2001), Barnes and Vidgen (2002), Gable, Sedera and Chan (2008)	The degree to which a user believes that using the system would be free of effort.
Information Quality Scales	Availability	Lee, Strong, Kahn and Wang 2002; Bovee, Srivastava and Mak (2003); Katerattanakul and Siau (1999)	The availability of self-help information on solving IT problems. This information is produced by a business for users and may be available in different formats (e.g. an online text file or an online video).
	Accessibility	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011); Katerattanakul and Siau (1999)	The available information is fast and easy to access for the user.
	Relevancy	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011); Herrera-Viedma et al. (2006)	The degree to which the available self-help information is relevant to solving a specific IT problem.
	Timeliness / Currency	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011); Herrera-Viedma et al. (2006); Klobas (1995)	The information is up to date (e.g. is for the latest version of a software or application).
	Accuracy	Lee et al. (2002); Bovee et al. (2003); Klobas (1995);	Correctness of the available information on a particular IT problem.

		Todoran et al. (2015); Arazy and Kopak (2011); Stvilia, Gasser, Twidale and Smith (2007); Katerattanakul and Siau (1999)	
	Completeness	Lee et al. (2002); Bovee et al. (2003); Herrera-Viedma et al. (2006); Todoran et al. (2015); Arazy and Kopak (2011); Stvilia, Gasser, Twidale and Smith (2007)	The thoroughness and comprehensiveness of information (e.g. an online text file/instructions includes all relevant steps to solve an IT problem).
	Consistency	Lee et al. (2002); Bovee et al. 2003); Arazy and Kopak (2011); Katerattanakul and Siau (1999); Stvilia, Gasser, Twidale and Smith (2007)	Consistency in format, style and presentation of information and consistency of the content available via different channels (e.g. text on a website, a downloadable text file or an online instructional video).
	Conciseness	Lee et al. (2002); Herrera-Viedma et al. (2006); Arazy and Kopak (2011)	Appropriate amount of information. Not too much and not too little.
	Understandability	Ge et al. (2011); Herrera-Viedma et al. (2006)	The information is provided in such a way that a user with a reasonable knowledge of IT is able to comprehend it.
	Originality	Herrera-Viedma et al. (2006)	The information is new or novel. It is reliable and can be distinguished from reproductions, derivative works, etc.
	Believability	Lee et al. (2002); Herrera-Viedma et al. (2006)	The extent to which a user can believe and trust the information provided for them.
	Reputation	Lee et al. (2002)	The extent to which the information is from a reputable and credible source.
* Note that 'interactivity' is a system quality related factor, as well, but it was identified from the e-service recovery studies, not from system quality studies.			

4.4.3 The Final List of Candidate Persistence Factors

In this last step of compiling the list of candidate persistence factors, we considered all of the selected persistence factors in the previous two sections and aimed to sort them into broad groups. These factors come from a variety of sources and multiple disciplines; therefore, we needed to use a method to evaluate and obtain consensus on the groups of factors among the research team. The affinity method (Tague, 2005) was chosen for this purpose. We wrote each factor on a sticky note paper and collaboratively sorted the related factors into broad groups based on similarities in their nature (e.g. 'information', 'IT/technology quality and characteristics aspects', and 'outcome/goal'-related). As a result, all factors were sorted into 6 broad groups. Next, we agreed on a name/label that best describes the factors in a group and wrote it on a header card for each group. The 6 groups

of factors which constitute our final list of candidate persistence factors include Personal Factors, IT Quality Factors, Situational Factors, Outcome/Goal-Related Factors, Cost-Related Factors and Self-Help Information Quality Factors. As explained, this list (Table 4.3) is used in the initial coding during our analysis of the primary data.

Table 4.3: The List of Candidate Persistence Factors	
Groups of Candidate Factors	The Candidate Factors
Personal Factors	Perceived Behavioural Control (perceived control over solving an IT problem)
	(Computer) Self-Efficacy
	Subjective Norm
	Attribution (of blame/failure)
IT Quality (for solving the IT problem)	Interactivity
	Usefulness
	Ease of Use
Situational Factors	Procedural justice (as a factor of service staff performance)
	Interactional Justice (as a factor of service staff performance)
Outcome/Goal Related Factors*	Gain (perceived value of the outcome)
	Probability (of an outcome)
Cost Related Factors (the factors that are perceived as 'cost' by a user if they persist in solving a problem)	(user's expected amount of recovery) Effort
	(user's expected amount of) Anxiety
Self-Help Information Quality Factors (e.g. the quality of 'how-to' information, online instructions, etc. provided by a firm for the users)	Availability
	Accessibility
	Relevancy
	Timeliness / Currency
	Accuracy
	Completeness
	Consistency
	Conciseness
	Understandability
	Originality
	Believability
	Reputation
* we considered 'cost' (in Table 4.1) as a group (including 'effort' and 'anxiety' factors) because of its comprehensiveness. Therefore, this final list of candidate factors includes 25 factors.	

4.5 FOCUS GROUPS

This section provides details on the focus group data collection method and the analysis procedure we followed to identify the factors that contribute to user persistence in solving their own IT problem (research question 1). It explains that how we gathered data through the focus groups method, particularly how the critical incident technique was employed to facilitate the procedure of this data collection (section 4.5.1); how we analysed the focus groups data through the open coding and axial coding steps of grounded theory approach to identify the factors (sections 4.5.2.1 and 4.5.2.2); and a report of the results of each of the open coding and axial coding steps. Table 4.10 presents the persistence factors in the form of groups and sub-groups. This section concludes with section 4.5.2.3 which explains the relationship between the factors (this is also a part of the results of axial coding step, which the selective coding step in the following section is built on its results to develop theory).

4.5.1 Data Collection through Focus Groups

As we aimed to study a broad range of IT problems, we chose work and study contexts, where the use of specific ITs may be mandatory (e.g. a university's learning management system to submit an assignment, specific systems to submit online applications or register for an event), while others are optional (e.g. available self-check systems at libraries), and where users can use their own mobile devices (e.g. smartphones and laptops) for the purpose of work and study. We chose user participants from the students, teaching staff and administrators at a large New Zealand university. The university provides user support service for the ITs mentioned. This allowed us to gather data across a range of IT problem-solving methods that a user may employ. We restricted the study to unobserved user problem solving behaviour (i.e. not in a public environment such as a classroom or a waiting line for using a self-check-out machine in a library) to eliminate environmental factors which might affect user persistence in IT problem solving.

After receiving approval from the Human Ethics Committee of the university, invitation emails accompanied by an information sheet were sent to all teaching staff and school administrators' email addresses. Students were informed through advertisement posters installed at all faculties and schools of the university and through snowball sampling. An effort was made to make sure

the participants in each focus group were diverse (in terms of age, gender, ethnicity, expertise, etc.) and consisted of participants from different university faculties. Overall, we conducted three focus groups with IT users. The first focus group comprised seven teaching staff, with positions ranking from tutor to professor. The second focus group comprised seven students, and the third focus group consisted of ten participants, including six students, two school administrators and two teaching staff.

To conduct the focus groups, we designed a semi-structured focus group interview protocol. The protocol included the following three questions, where the first and second questions were formulated in relation to the critical incident technique, and the third question aimed to generate group discussion to elaborate on user persistence in solving their own IT problem. Participants were asked to: (1) recall a problem with a work- or study-related IT that occurred during the six months prior to the focus group session, and how it was solved (e.g. the steps taken to solve the problem, satisfactoriness of the outcome, etc.); (2) provide opinions about their persistence, whether persistence was important in solving their IT problem, and the factors that contributed to user persistence in solving the problem they mentioned, and (3) engage in a group discussion to elaborate on their persistence in solving their IT problems, the factors that they believe contribute to this persistence, and why they decided to give up or continue to solve the problems at different stages. Probe questions were also asked where the moderator sought more clarity on the participants' comments and where he felt more comments on user persistence could be achieved.

We video recorded all focus groups and transcribed the records carefully. Overall, we identified and discussed 52 events of perceived IT problems, 41 of which are distinct significant events, and the rest were problems that had previously been identified by another user (i.e. significant events narratives through the first question above). See appendix 4.2 for a brief presentation of these events. These events were discussed through the second and the third questions to identify and elaborate on the factors that contribute to user persistence in solving their own IT problem. No new idea or theme associated with user persistence was identified during the third focus group (although new types of IT problems continued to be identified); therefore, we did not conduct a further focus group.

4.5.2 Focus Group Data Analysis Procedure and Results

The focus of this study is on an individual user. Therefore, verbal content data (i.e. a participant's response in the form of words and sentences in response to the moderator's question, and without any interaction with other participants) is the only 'theoretical sensitive' (Nili et al., 2014c) type of data for this research. We only focused on the simple and readily understandable non-verbal content data (e.g. when a participant responds to a moderator's question through moving their head, a body gesture or a facial expression, and without any interaction with other participants) to ensure good understanding of their associated verbal responses. Both verbal and non-verbal interaction data (e.g. a participant's verbal or none verbal response to another participant's question, conflict, or supporting and encouraging another participants) were considered with a low level of precision (i.e. only the simple and readily understandable participants' interactions were considered) since detailed interaction data does not contribute to the purpose of the study and to answering the research questions.

Our analysis of the focus group data followed the steps of a grounded theory approach (Strauss and Corbin, 1990, 1998) and the focus group data analysis framework proposed by Nili et al. (2014c). Nili et al.'s (2014) framework is a systematic and integrative framework for qualitative analysis of focus group data for IS researchers. See Table 3.3 in Nili et al.'s paper for a summary of their analysis framework. We used the analysis framework because of its relevance to the IS research and its flexibility for the analysis of different types of focus group data.

We read the transcripts and reviewed the video records several times to identify the content areas (the sentences or paragraphs of the transcript that are about a distinct issue, such as all parts of the text related to the technology characteristics and quality aspects of IT). Next, we aimed to identify the persistence factors within each content area (the first step of data analysis, cf. Strauss and Corbin, 1990, 1998). We considered the candidate factors in our list as our initial codes. By a code we mean a label that reflects the core content and meaning of data chunks such as words, sentences or paragraphs (Miles, Huberman and Saldana, 2014; Strauss and Corbin, 1990, 1998). For each of the six content areas, some of the existing factors in the list were identified and were selected for the next steps of analysis without any change in their name/label, and some were modified slightly

because of the IT context of this study. In addition, several emergent factors not on the list were identified. None of the candidate factors were excluded as the result of this coding step. Each of the factors we identified was considered for the possibility of whether it can be partitioned into smaller and more specific factors (Miles et al., 2014; Strauss and Corbin, 1990, 1998). As a result, one factor related to the situational content area was partitioned into two more specific factors. This process of identifying factors was an iterative process performed continuously.

Next, following the axial coding step, the identified factors were sorted into broad groups based on the similarities in their concepts and nature. Each group was further revisited for the possibility of being divided into sub-groups. Each of the sub-groups was labelled with a name that represents the related factors, and each group was labelled with a name that represents its sub-groups. This process of grouping the factors required us to revisit and, where necessary, modify the results of the previous phase of analysis (focusing on the factors we had already identified) and needed several rearrangements, refinements and integration of the groups (constant comparison). The results of the analysis of each content area were organised through a table to clarify the way data was linked with the sub-groups and the groups. Such tables facilitated agreement within the research team (e.g. agreement on the suitability of the label of each factor, sub-group and group) (Miles et al., 2014; Nili et al., 2014c). Moreover, in our axial coding step, we used note-taking and diagrams (memoing) to keep track of and refine our ideas to efficiently discover the general relationships between the groups and to help explain the persistence phenomenon. We then illustrated these groups and the relationships between them through figures.

Lastly, during the selective coding step we further refined the groups of factors by selecting the ones which contribute to user persistence the most, further elaborated on the nature and concept of each of them, and logically related the groups to each other. This coding process enabled us to explain the larger patterns and relationships and present our persistence theories.

Below, we present the results of the first and second steps of our focus group data analysis. We start with a description of the methods that a user may employ to solve their own IT problem, and continue by presenting the factors that contribute to their persistence in solving the problem, the sub-groups and groups of these factors, and the relationships between the groups of factors. The

results of the third step (selective coding) of the focus groups analysis will be presented in section 4.7 where we present our arguments and generate our two persistence theories. As explained below, the results of the individual interview analysis are consistent with the results presented in this section, and supported our argumentation in theory generation.

4.5.2.1 The methods of solving IT problems

Across all three focus groups it was clear that in the event of a perceived IT problem, a user often employs more than one method of IT problem solving. We identified four methods of solving IT problems from the user perspective. These include: (1) the user performs the entire problem recovery through their own efforts and may use FAQs, troubleshooting features and any self-help information provided by the business, such as online instructions, video tutorials, etc. We call this way of solving the problem the self-recovery method; (2) the user asks for help from other users such as a friend or colleague in an offline environment, such as an office, or via an online community of users such as Internet forums. We call this the community-recovery method; (3) both user and user support staff participate in solving the problem and try to solve it jointly/collaboratively – the joint-recovery method; (4) and finally, the firm-recovery method, where nearly all of the problem recovery is done by the user support staff.

In this regard, many users commented on the high importance of their persistence in solving their IT problems, even through the firm-recovery method. For example, one participant commented:

> *"…It is not simply a matter of saying, ok I am giving my problem to customer service and then I just fold my arms and forget about the problem while they fix it. You (the participant points randomly to other participants) are the one who wants a solution. … In your case (randomly pointing to another participant) for example, you handed it back and forth more than once before you were satisfied with the solution".*

4.5.2.2 Factors contributing to user persistence

After reading the transcripts several times, we first identified six content areas, including the segments of the transcript discussing personal beliefs (e.g. the user's belief about whether they

have control over solving the problem); the segments about characteristics and quality aspects of an IT (that has a positive or negative influence on user persistence in solving the problem with it, such as the perceived interactivity of the IT); situational factors (e.g. the text about the quality of user support service); outcome/goal (satisfactory outcome) related factors; the parts which are about the user's perceived cost (e.g. the expected amount of time and effort required) to solve an IT problem; and the segments about self-help information quality related factors (e.g. accessibility and reliability of this information). The rest of this section explains the results of the focus groups data analysis.

Our analysis of the content area about personal beliefs led to an identification of the four candidate personal factors in the list (including perceived behavioural control, computer self-efficacy, subjective norm and attribution of blame/failure), relabelling some of them, and identifying a new personal factor. Regarding the perceived behavioural control factor, several participants expressed that the extent to which they believe they have control over solving an IT problem contributes to their persistence in solving the problem through their own efforts. For example, one participant commented:

> *"…because, for my problem, I cannot have the admin right [to make the necessary changes], so sometimes I found the answer, but I could not apply it to my computer."*

We labelled this belief as Perceived Control over Solving the Problem. This label is more commensurate with the participants' comments on their persistence behaviour in solving IT problems.

The contributing role of computer self-efficacy when solving an IT problem through one's own efforts, was confirmed through quotes like *"I believe I can handle these problems by myself".* We labelled this factor IT Self-Efficacy.

The importance of the subjective norm factor (e.g. the extent to which an administrator or a student user believes that colleagues or friends think that they should solve the problem) was evident in many participants comments, such as *"…their opinion was important; I [felt] I have to solve it".*

Next, the contribution of attribution (of blame/problem) factor was confirmed through several quotes like:

- *"Well, the problem is not me." [participants laugh].*
- *"But I usually think it is me. I usually just think I am ignorant. There should be a button somewhere that I have not seen or a drop down box."*

Lastly, from several participants' comments like the one below, we identified the contribution of Prior Knowledge gained through previous experiences of solving similar IT problems.

"It depends on how much we know… so based on our previous experiences we decide what our course of action would be."

Overall, the analysis of the content area about personal beliefs did not lead to exclusion of any candidate personal factor. The analysis led to the identification of one new persistence factor (prior knowledge) and modification of the labels of two factors. The new labels are perceived control over solving the problem and IT self-efficacy. We grouped these five factors into the Personal Factors group. Table 4.4 presents the five persistence factors within this group.

Table 4.4: The Personal Factors	
Group	Persistence Factors
Personal Factors	IT Self-Efficacy
	Prior Knowledge
	Attribution (of blame/ cause of problem)
	Subjective Norm
	Perceived Control over Solving the Problem

Next, we analysed the content area involving characteristics and quality aspects of ITs. First, the interactivity factor, was confirmed through participants' comments such as:

"scanning; yeah you press scan, yeah fine, how do I get that on that university computer now? It was straightforward. It looked like, okay, transfer to external device and stuff like that. So I just followed all the things [it asked me to do], like talk me through, basically."

"But a flip side of that is software that tries to be so annoyingly helpful and knows what you want to do yourself, and you say, 'I want to do this'; 'are you sure you want to do this?'; 'Yes I do.'; 'Are you really?'"

In addition, the analysis of the content area, led to identifying Ease of Use and Usefulness of IT. From several participants' responses, it was evident that in the event of an IT problem, a user's perceived ease of use of an IT can help and encourage them to persist in solving a problem with that IT. With regard to the usefulness factor, the quote below is an example of several quotes showing why a user may stop solving an IT problem if they believe that the IT is not really useful.

"For software that you want to know it completely, be in charge and see what that software does, persistence is very important…"

We grouped these three factors into the IT Quality Factors group (Table 4.5).

Table 4.5: The IT Quality Factors	
Group	Persistence Factors
IT Quality Factors	Interactivity
	Ease of Use
	Usefulness

During the analysis of the content area about situational related factors, we first identified procedural justice and interactional justice candidate situational factors. However, participants' comments like the ones below show a higher coverage of the service staff performance quality aspects than the procedural and interactional justice factors do. For example, the comment below shows the importance of the quality of service staff performance where the majority of the problem solving is performed by service staff and where the user participation is limited to reporting the problem and checking the outcome.

"So I phoned [a user support staff name] and he said no problem. He was there within 10 minutes, solved my problems, and gets it all going."

We labelled this factor Firm-Recovery Quality. Also, the comment below shows the importance of the quality of service staff performance where the user and a service support person try to solve

the problem jointly/collaboratively. We labelled this factor Staff Joint-Recovery Performance Quality.

> *"So I had them on the phone and we tried to solve it. They couldn't work out what it was. [My] description [of the problem] was not enough."*

In addition to these two factors, several comments showed the importance of the availability and quality of a community of users to a user's persistence in solving their own IT problem. According to the comments, a community of users can be colleagues or friends in a physical environment such as workplace or an online environment such as a discussion forum dedicated for the users. We labelled this factor Quality of Community of Users.

> *"No, [not just service support staff], it could be other users. A lot of people probably already know many tricks about it and they could contribute [a great deal]."*

> *"The only thing I could do was to join the discussion forum…I have found it quite amazing that these discussion forums really solved the problem."*

The factor was also identified from several participants' comments during our interaction analysis. An example of such interactions is a participant's supportive response when she realised another participant's feeling of frustration about solving an IT problem:

> *"…but at least it signals to me …, okay it's not me. … It is an ongoing issue… and there's nothing I can do about it so I have to keep living with it, which is bad but at least, okay it not me who's just too dumb to solve it"*

Such pairing interaction (intimacy or a supportive expression) boosts the validity of the quality of community of users factor.

Overall, our analysis of the content area about situational related factors led to modifying the labels of the two candidate situational factors and identifying a new factor. We grouped these three persistence factors into Situational Factors group (Table 4.6).

Table 4.6: The Situational Factors	
Group	Persistence Factors
Situational Factors	Staff Joint-Recovery Quality Performance Quality
	Firm-Recovery Quality
	Quality of Community of Users

Next, during the analysis of the outcome/goal related content area, we recalled the two candidate outcome related factors including gain (importance of the outcome/goal) and probability. From comments such as the one below, we identified the direct contribution of the importance of the outcome to user persistence with any of the four methods of IT problem solving (e.g. the first comment below) and to the whole process of problem solving (the second comment). In order to clarify the concept of the factor, we modified its label to be Importance of a Satisfactory Outcome (i.e. the importance of achieving an outcome that is satisfactory for the user). The factor was mentioned explicitly by all participants.

> *"I needed it… Any solution that works is enough for me."*

> *"I think also [there is] the importance of the output – what I want to achieve … because eventually the output is the most important thing."*

The probability factor was identified and was modified to Probability of a Satisfactory Outcome, as by probability participants meant their perceived probability of achieving a satisfactory outcome while they were persisting in solving their own IT problem. This factor was mentioned by all participants explicitly or implicitly, and its direct contribution to user persistence with each method of IT problem solving, and to the whole process of problem solving, was clear in the comments.

> *"I don't know how far I will persist to solve a problem if it is a technical problem to do with the software. I think I will persist until I solve it."*

We grouped these two persistence factors into the Outcome-related Factors group (Table 4.7).

Table 4.7: Outcome/Goal-related Factors	
Group	Persistence Factors
Outcome/Goal- related Factors	Probability of a Satisfactory Outcome
	Importance of Satisfactory Outcome

The analysis of the content area about cost-related aspects led to identifying the two perceived cost factors including the expected (amount of) effort and expected (amount of) anxiety factors from the list. For example, the comment below shows the importance of expected effort:

> *"I may be just investing more effort and some cost… You may continue to make the investment."*

In addition to anxiety, the analysis of this content area led to identifying frustration as a negative emotion. For example, a participant commented:

> *"When you are more frustrated …, you are less likely to be thinking thoroughly or willing to spend time…"*

According to several comments, a user expects the endurance of anxiety and/or frustration, if they decide to persist in solving the problem. Therefore, we modified the label of expected anxiety to Expected Negative Emotions. The modified factor covers both anxiety and frustration emotions.

In addition to the expected effort and expected negative emotions, many comments like *"I don't waste time. I phone someone"* show the importance of time required to be invested/incurred to solve a problem if the user decides to persist in solving it. Therefore, like the two previous cost-related factors and from the user's perspective, Expected Time was considered as a cost factor.

Overall, the analysis of this content area confirmed the expected effort factor, and the expected negative emotions factor, which was changed from expected anxiety. Expected time was identified as a new cost-related factor. We grouped these three factors into the Cost-related Factors group (Table 4.8). At least one cost-related factor was mentioned by each participant, making clear the direct contribution of each factor to user persistence either in the entire process of solving IT problems (e.g. the first comment above) or with a specific method (the second comment).

Table 4.8: The Cost-related Factors

Group	Persistence Factors
Cost-related Factors	Expected Amount of Time
	Expected Amount of Effort
	Expected Negative Emotions (anxiety and frustration)

Lastly, the analysis of the content area about quality of self-help information identified all of the twelve candidate self-help information quality factors in the list, as well as two new factors. The aavailability factor was identified from several participants' comments, such as *"there were no instructions and I couldn't work out how to do it"*, and accessibility was identified through comments like "*I have access to different sorts of information, so I try to use that information to fix it myself."* Several participants also brought up the timeliness factor, for example:

> *"…So what I did, I just Googled, first, for the solution because [maybe] they have [a support] group for NVivo. But the thing is, all their solutions were for [version] 9, not for the latest one…, not for [version] 10."*

Respondents also indicated that completeness of self-help information contributes to their persistence. For example, one participant mentioned:

> *"Before this I was just Googling, but now I use YouTube more than Google, because it gives practical information, not just information."*

The importance of the relevancy factor was indicated by comments such as:

> *"Usually the ones that [are] more relevant are in the first page [of a search response, and] are more likely to solve the problem… [the search engine] is more intelligent in the way that it will identify relevant information."*

The contribution of consistency of the self-help information to user persistence was confirmed by comments such as "*for one problem, you have got different information in different instructions"*. The conciseness factor was indicated by comments such as "*so much information, even though you try to be specific and use specific keywords. I just tend to ask a human being how to do that."*

The contributing role of the accuracy factor and understandability factor to user persistence was also evident in many participants' comments (e.g., *"the information was correct…which was an important reason [to persist]"* and *"I could not understand the meaning…[that is why] I didn't continue working on it" respectively*). The importance of the believability factor was highlighted

by comments such as *"a user says I did* this, *which had* this *result, and another user may say I did* this *and it magically worked."* The role of the originality factor is demonstrated in quotes such as *"if it (the information) is original, I continue…"* and comments like *"if the information I find online was provided by a reputable source…"* indicate the importance of reputation of information.

The analysis of the content area about the quality of self-help information identified two new factors, including Ease of Obtaining Information and Contextualisation (i.e. presentation of information in a way that supports the user in recognising its relevance to a particular topic). The ease of obtaining information factor was identified through comments such as *"… it's easier if [a] company has its own website where they say for [the issues with] product A lookup this link, and [for the issues with] product B lookup that link"*. The comment below is an example of several comments through which we identified the contextualisation factor:

> *"Even though you try to be specific and use specific key words [in the search function], there is nothing that matches."*

Next, we selected the factors which were conceptually similar and sorted them into sub-groups. Among the 14 factors, the believability, originality and reputation factors were assigned to the Reliability sub-group. As mentioned in our literature review section and Appendix 4.1, a user relies on the information, if it is believable, original, genuine and reputable. Next, the availability, accessibility, and ease of obtaining information factors were sorted into the Obtainability sub-group. The relevancy, completeness, timeliness/currency, understandability and accuracy factors were sorted into the Usefulness sub-group. Indeed, if the self-help information is obtainable, but it is not up-to-date, is not relevant to a particular version of an IT, is incomplete, is wrong or is not easy to interpret, the information is not useful enough and does not help the user to solve the IT problem. Next, the 3 factors including conciseness, consistency and contextualisation were considered in the Presentation sub-group because of their relevance and contribution to a high quality presentation of information. Finally, these 4 sub-groups were grouped into a Self-Help Information Quality Factors group. Table 4.9 presents the way the 14 identified factors are linked to their related sub-groups within the self-help information quality factors group.

Overall, the analysis of the content area related to quality of self-help information confirms the 12 candidate self-help information quality factors. In addition, the analysis of the content area identified 2 new factors, including ease of obtaining information and contextualisation, and led to a more precise grouping of the factors by sorting them into 4 sub-groups within the group.

Table 4.9: The Self-Help Information Quality Factors

Group	Sub-groups	Persistence Factors
Self-Help Information Quality Factors	Usefulness	Relevancy
		Completeness
		Timeliness / Currency
		Understandability
		Accuracy
	Obtainability	Availability
		Accessibility
		Ease of Obtaining Information
	Presentation	Conciseness
		Consistency
		Contextualisation
	Reliability	Originality
		Believability
		Reputation

In summary, all of the candidate factors in the list were identified during our focus group data analysis, 7 of which were relabelled to improve their suitability for the context of user persistence in solving their own IT problem. These 7 modified factors include IT self-efficacy, perceived control over solving the problem, staff joint-recovery performance quality, firm-recovery quality, probability of a satisfactory outcome, importance of satisfactory outcome, and expected negative emotions. We also identified 5 new persistence factors including prior knowledge, ease of obtaining information, information contextualisation, quality of community of users and expected amount of time (required to solve the problem). As the result, we identified 30 persistence factors that contribute to user persistence in solving their own IT problem. These were grouped into sub-groups and groups based on their similarity and nature. Compared with the 6 groups already identified and presented in the list of candidate factors, there is no change in the name/label of these groups, as the name of each group suitably represents the factors in that group. However, compared with the list in which none of the groups include any sub-group, our analysis led to the identification of 4 sub-groups of factors within the self-help information quality group. These

include usefulness, obtainability, presentation and reliability sub-groups. Table 4.10 presents all 30 final persistence factors in their related sub-groups and groups[26].

Table 4.10: The Groups and Sub-groups of Persistence Factors		
Groups and Sub-Groups	Persistence Factors	
Personal Factors	IT Self-Efficacy	
	Prior Knowledge	
	Attribution (of blame/ cause of problem)	
	Subjective Norm	
	Perceived Control over Solving the Problem	
IT Quality/Characteristics Factors	Interactivity	
	Ease of Use	
	Usefulness	
Situational Factors	Staff Joint-Recovery Performance Quality	
	Firm-Recovery Quality	
	Quality of Community of Users	
Outcome/Goal-related Factors	Probability of a Satisfactory Outcome	
	Importance of Satisfactory Outcome	
Cost-related Factors	Expected Amount of Time	
	Expected Amount of Effort	
	Expected Negative Emotions (anxiety and frustration)	
Self-Help Information Quality Factors	Usefulness	Relevancy
		Completeness
		Timeliness/Currency
		Understandability
		Accuracy
	Obtainability	Availability
		Accessibility
		Ease of Obtaining Information
	Presentation	Conciseness
		Consistency
		Contextualisation
	Reliability	Originality
		Believability
		Reputation

[26] We also considered identifying the number of times a persistence factor was found in each focus group; however, we believe that identifying such number is more applicable for the methods such as individual interviews, where a researcher collects data from each participant separately. We believe that for a focus group environment, this number includes both the participant mentioning a factor and the number of participants agreeing with him or her through verbal or a non-verbal expressions (e.g. facial expressions or any expression through body language) during the significant events narratives part (the first part) of analysing each focus group. Identifying such numbers for each focus group could have been more practical, if we did 'vote counting' in each group. The vote counting practice is clearly not applicable for this grounded study (it is possibly more applicable for a deductive study). Also, we believe that such a report of numbers does not add a significant value to this study since we have done it for the data collection through the individual interviews method, and because obtaining unbiased and reliable data was also supported through conducting the second part (group discussion and elaboration) of each focus group.

4.5.2.3 The relationships between the factors

In addition to the identification of the groups and sub-groups of persistence factors, our axial coding step of analysis identified how they are related to each other. According to the results of the first step of our data analysis (explained above) and based on our memos during the entire analysis of the focus groups, we realised that some of the factors contribute directly to a user's persistence in solving their own IT problem, while other factors do so indirectly. In this regard, we found that probability of a satisfactory outcome, importance of a satisfactory outcome, and expected cost directly contribute to user persistence with any method of solving the IT problems, and to user persistence with the overall process of IT problem solving. All other factors contribute to user persistence indirectly.

For the purpose of clarity, we use the terms probability of (achieving) a satisfactory outcome using a specific method: P(SOM), for example P(SOM) through self-recovery method; probability of a satisfactory outcome across the whole process: P(SOP); expected method cost (e.g. expected cost of self-recovery method): EMC; and expected process cost: EPC. Unlike probability of a satisfactory outcome and expected cost factors which will vary across different methods and across the entire process (thus, they need to be distinguished with different abbreviations for each of method persistence and process persistence), importance of a satisfactory outcome (ISO) will remain unchanged and is applicable for any method of IT problem-solving and the overall process of solving the problem.

We found that each of the personal factors (e.g. IT self-efficacy), IT quality factors (e.g. IT interactivity) and self-help information quality factors (e.g. understandability of the information) directly influence P(SOM) with the self-recovery method, which itself directly contributes to user persistence with the method. These relationships were identified from the participants' comments, which show their belief that each of these factors increases the likelihood of solving the problem by their own efforts. For example, the comment below shows how the IT interactivity factor (a factor within the IT quality factors group) contributes to P(SOM) with the self-recovery method:

> *"The moment I tried to restart the computer, I was prompted through a message to save what I've done… I moved on [through the guidance I received] to solve it."*

Figure 4.1 illustrates the relationships between these groups of factors. These identified relationships are completely consistent within each focus group and across the three focus groups. In other words, no contradictory comment or any comment that explicitly or implicitly shows a different relationship among these factors was identified in any of the focus groups.

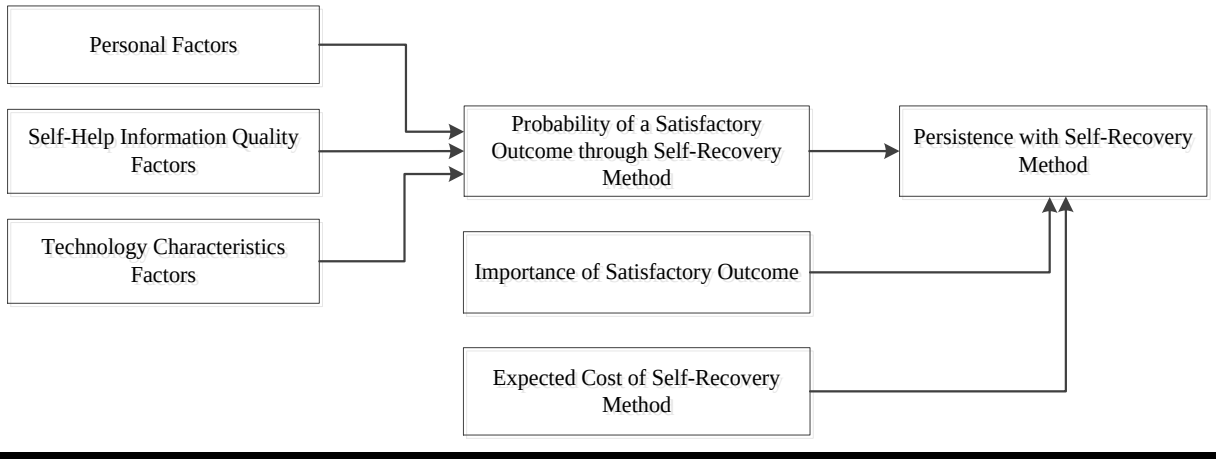

Figure 4.1: Factors Contributing to User Persistence with Self-Recovery Method

We also realised that the quality of community of users influences P(SOM) with the community-recovery method, which directly contributes to user persistence with the method. For example, the comment below shows that how the quality of community of users increases a user's perceived likelihood of solving the problem through the community-recovery method and that this increased P(SOM) influences user persistence with the method.

> *"… I visited a discussion forum and started talking with someone… He started giving me recommendations to do this and do that. We were talking at a level of very dirty tricks that you can do on computers [participants laugh]… like I was hopeful about it. [That's why] I spent one full day working on it, with his ping pong, do this, do that."*

Figure 4.2 illustrates the relationships between these groups of factors. Like the relationships shown in Figure 4.1, these relationships for the community-recovery method are completely consistent within each focus group and across all three focus groups.

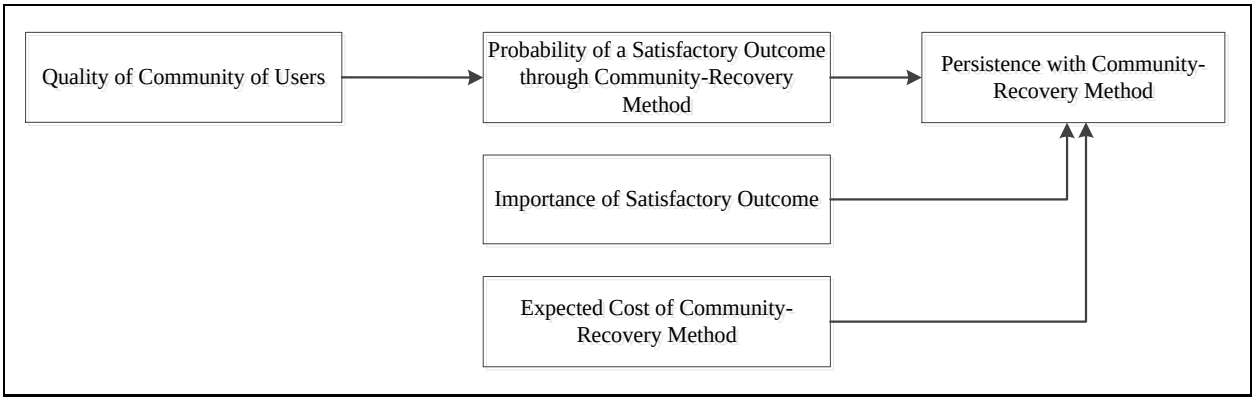

Figure 4.2: Factors Contributing to User Persistence with Community-Recovery Method

Similarly, we identified the influence of the quality of user support service staff performance on P(SOM) with joint-recovery (e.g. the first comment below) and P(SOM) with firm-recovery methods (the second comment). Similar to the above relationships, the P(SOM) with the joint-recovery method directly contributes to user persistence with this method, and P(SOM) with firm-recovery method directly contributes to user persistence with that method. Similar to the previous models, these relationships are completely consistent within each focus group and across the three focus groups, i.e. no comment showing a different relationship among these factors was identified in any of the focus groups.

> *"When I called them, and after a couple of calls from students, [the support staff] said that they just realised that the problem [with the library's database search feature] has happened. They were not expecting this problem. Then, they asked me to do some searches by myself in the previous databases. We were not sure about any positive outcome."*

> *"I was pretty hopeful that this [method] would work. I just needed to wait [for a short time] for them (user service support) to respond… and check the result."*

Figure 4.3 and Figure 4.4 illustrate these relationships.

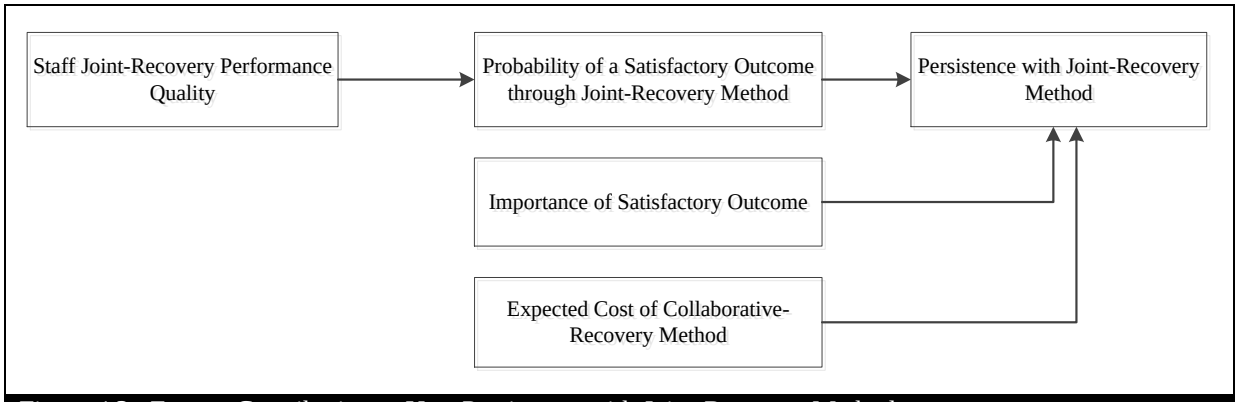

Figure 4.3: Factors Contributing to User Persistence with Joint-Recovery Method

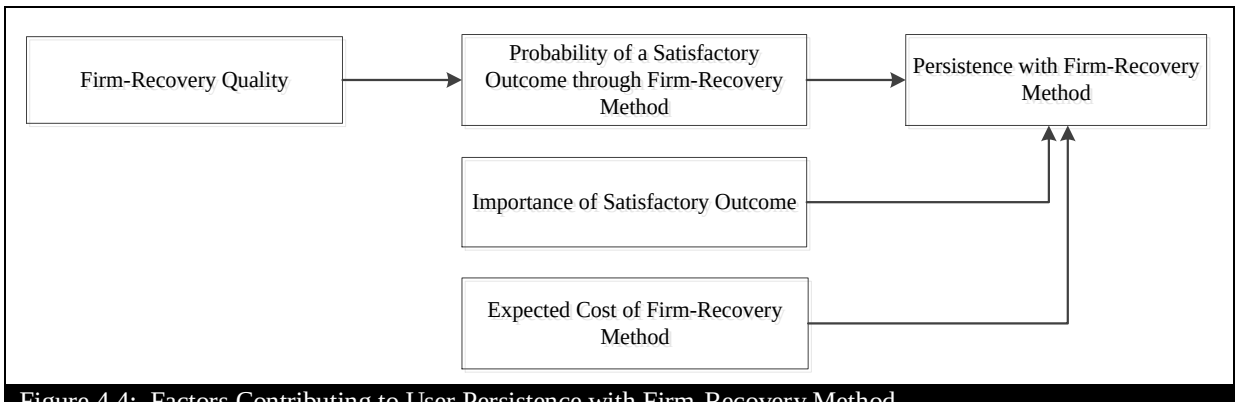

Figure 4.4: Factors Contributing to User Persistence with Firm-Recovery Method

As mentioned in the first step of our analysis (identification of persistence factors) and according to our memos during the entire analysis of the focus groups data, P(SOP), ISO and EPC are the factors that directly contribute to the larger pattern of user persistence with the overall process of IT problem solving. Figure 4.5 illustrates the relationships between the factors that contribute to user persistence with the overall process of solving an IT problem.

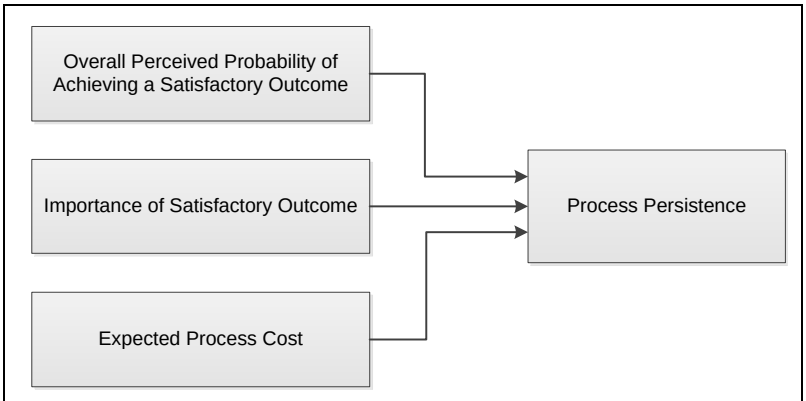

Figure 4.5: Factors Contributing to Process Persistence

As discussed in the next section, the results of the individual interview analysis are consistent with the results presented in this section. The results of the third step (selective coding) of the focus groups analysis accompanied by the relevant findings of the individual interviews are presented in section 7 where we explain how we generated our two persistence theories.

4.6 THE INDIVIDUAL INTERVIEWS METHOD AND RESULTS

The individual interview method was employed mainly for the purpose of collecting more data through a different method (other than the focus group method) from different participants (i.e. no overlap in participants between the focus groups and individual interviews) who have experienced different IT problems; therefore, allowing any new factor or theme not identified through the focus groups, or any conflicting result, to be identified (i.e. for the purpose of triangulation and ensuring the consistency and completeness of the findings already identified through the focus groups). To conduct the interviews, the same types of IT (work- and study-related ITs) and the same types of participants (IT users including students, teaching staff and school administrators, but different individuals) at the same university were considered. After receiving approval from the researchers' university Human Ethics Committee, we invited the users to participate in the study.

We used the same channels of communication we had used for the focus group method. Through our emails and information sheet the participants were asked to take note and send (via email) a short description of the event(s) of an IT problem that occurred during the two weeks after agreeing to participate. Participants were notified that these notes would be reviewed by the interviewer before the interview, and that the interview would be based on the problems reported. Also, they were informed that at least one instance of an IT problem was the minimum requirement and the two week period may be extended if no IT problem had occurred. We note that this phase of the study did not use the critical incident technique, as the events of IT problems the participants report them in their notes during a relatively short period of time prior the interviews (i.e. the events are not obtained through participants' recall of those events) do not necessarily represent significant events of IT problems.

Overall, 30 participants from a diverse range of background (in terms of e.g. age, gender, ethnicity and expertise) agreed to participate and attended the interview sessions. Each interview took between 25 to 50 minutes, dependent on the number of IT problems mentioned by each participant. The interviews were conducted at the University for participant convenience. All interviews were audio recorded and fully transcribed. In addition, field notes were taken during, and right after, each interview, and summaries and synthesis of the important details were done while data collection was in progress. These summaries enabled a clear vision and understanding of the initial results at each stage of data collection, promoting agreement among the primary researcher and his colleagues about the initial findings, and guiding the determination of theoretical saturation (i.e. no new factor, idea or theme is received during the last few interviews). We did not receive any new factor, theme or idea about user persistence after the twentieth interview; therefore, we did not continue conducting any further interviews after the thirtieth interview.

The interview questions included a similar set of questions to the focus groups, but excluding the parts related to the group discussions. During each interview, we asked each participant to (1) describe the problem briefly; and then discuss (2) why they believe it is a problem; (3) why they persisted in solving it; (4) whether they believe that their persistence was important in solving the problem (to achieve a satisfactory outcome); (5) what things helped them or had a negative effect on their persistence in solving the problem; and (6) whether they have any further comment about factors that contributed to their persistence. Each user was also asked probing questions, dependent on the response to each question and when the interviewer felt that more information on the topic could be achieved. The knowledge that the interviewer had achieved through the results of the focus groups analysis helped him in formulating the probe questions during each interview. The probing questions sometimes led to obtaining more detailed participants' comments on each factor and sometimes led to simple responses in the form of agreement or disagreement on the contribution of a factor to their persistence.

Overall 51 events of IT problems were identified (the first and the second questions of the interviews). See Appendix 4.3 for a brief presentation of these events. The data analysis of the individual interviews (for questions 3 to 6) followed the accepted qualitative analysis techniques (Miles et al., 2014). In our analysis of the interviews, verbal data was considered with a high level

of precision, and non-verbal data was considered with a low level of precision and only for the purpose of ensuring a good understanding of the meaning of verbal responses. The analysis of the individual interviews identified the same persistence factors as those in the focus groups data analysis. This also means that no new sub-group or group of factors was identified from the analysis of the individual interviews. Moreover, compared with the results of the axial coding step of the focus groups analysis, our field notes, memos and summaries of the important details during the analysis of the interviews did not lead to identifying any new relationship between the groups of factors.

Although the overall results of the individual interviews analysis are consistent with the results of the focus groups analysis, we found some new codes in relation to the prior knowledge and cost factors. For example, some participants mentioned the contributing role of prior experience to their persistence with a method. However, this code was not considered as a new persistence factor, as by prior experience the participants meant prior knowledge gained through prior experience of solving a similar problem with a certain method. The prior knowledge factor was already identified through the focus groups and some of the individual interviews. For example, during an individual interview, one participant mentioned:

> *"I was pretty sure I'd be able to resolve the problem on my own since I've had the experience of doing it… The knowledge I gained basically. Knowing that there are certain steps that you can take to try to resolve the problem, and don't involve anybody else because it's time consuming for them."*

Moreover, a few time-related codes including time importance, time constraints and time criticality were identified during the analysis. However, none of these was considered as a new persistence factor, as the participants' responses to the interviewer's probing questions and the latent content analysis show the concept of time as a cost-related factor. Cost-related factors were already identified during the focus groups and individual interviews. For example a participant mentioned:

> *"I wasn't getting the result and I felt that I had some other things that had priority over this, and I needed to give attention to them. I perceived that, probably, since I cannot*

resolve it, it will require time and searching more information, and I'm not prepared to [go to that effort]… I had more important things to do, like my research work."

Overall, compared with the results from the focus groups analysis, the analysis of the individual interviews did not identify any new persistence factors, sub-groups or groups of factors, and did not identify any new relationships between the factors. Table 4.11 presents the number of times each persistence factor was mentioned by each participant directly and in response to the probing questions.

Table 4.11: Number of Times Each Persistence Factor Was Mentioned in the Individual Interviews

Groups and Sub-Groups of Persistence Factors		Persistence Factors	Number of Times
Personal Factors		IT Self-Efficacy	40
		Prior Knowledge	28
		Attribution (of blame/ cause of problem)	25
		Subjective Norm	25
		Perceived Control over Solving the Problem	31
IT Quality/Characteristics Factors		Interactivity	41
		Ease of Use	27
		Usefulness	26
Situational Factors		Staff Joint-Recovery Performance Quality	29
		Firm-Recovery Quality	28
		Quality of Community of Users	39
Outcome/Goal-related Factors		Probability of a Satisfactory Outcome	50
		Importance of Satisfactory Outcome	50
Cost-related Factors		Expected Amount of Time	40
		Expected Amount of Effort	45
		Expected Negative Emotions (anxiety and frustration)	43
Self-Help Information Quality Factors	Usefulness	Relevancy	28
		Completeness	25
		Timeliness / Currency	26
		Understandability	29
		Accuracy	26
	Obtainability	Availability	34
		Accessibility	32
		Ease of Obtaining Information	29
	Presentation	Conciseness	27
		Consistency	25
		Contextualisation	25
	Reliability	Originality	26
		Believability	28
		Reputation	26

4.7 THEORIES OF METHOD PERSISTENCE AND PROCESS PERSISTENCE

Building on the results of open coding and axial coding steps, we next followed the selective coding step of grounded theory method to formulate our two persistence theories. The step, which is frequently mentioned as the most important step of the method (Strauss and Corbin, 1990) involved refining the persistence factors (by focusing on the ones that contribute to user persistence the most), providing a more comprehensive definition for the selected ones to help logically relating them to each other, and finally, describing what these relationships together mean. The rest of this section explains this procedure and presents our two resulted theories of persistence.

From the results of the axial coding step, it is clear that the larger relationships and patterns are between user persistence (the core construct) and each of the factors that directly contribute to it (see Figures 4.6 and 4.7). In order to generate our persistence theories we focused only on these factors. By narrowing the focus to three factors each for method persistence and process persistence, we were able to refine our findings and develop two parsimonious theories of user persistence.

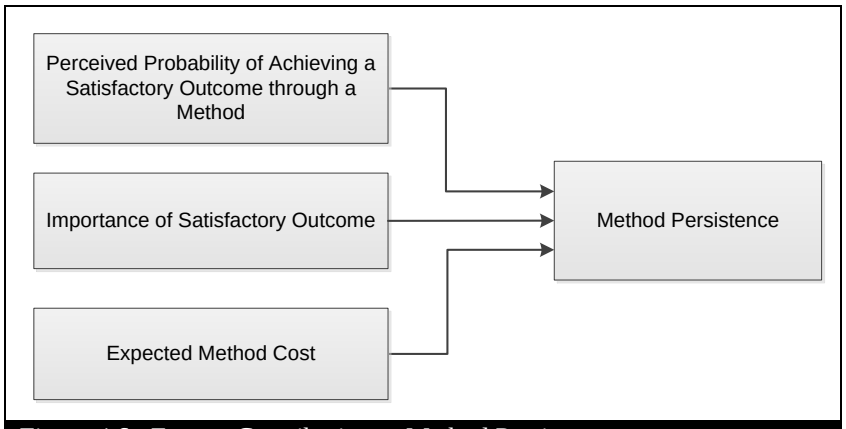

Figure 4.6: Factors Contributing to Method Persistence

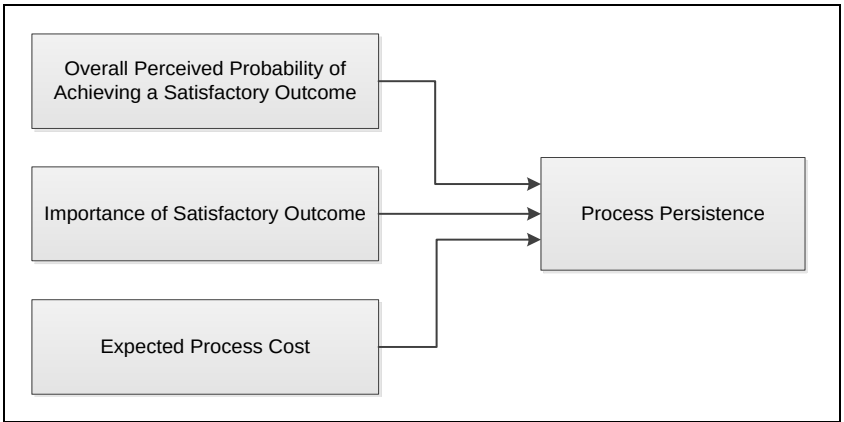

Figure 4.7: Factors Contributing to Process Persistence

Among the three factors identified, the term importance within importance of satisfactory outcome (ISO) is a value that a user assigns to the satisfactory outcome of solving their IT problem (i.e. 'how much' the achievement of a satisficing outcome is important for the user), and can be measured for example through a scale ranging from 'not important at all' to 'essential'. Also, the user's perceived probability of achieving a satisfactory outcome (i.e. probability of a satisfactory outcome: PSO) can be expressed by a probability percentage. Therefore, if these two factors are considered in tandem, they together represent the user's expected value of a satisfactory outcome (i.e. Expected Satisfactory Outcome: ESO) which can be considered as 'expected benefit'. Equation 1 represents this relationship.

> *Equation 1: Expected Satisfactory Outcome = [(Probability of a Satisfactory Outcome) * (Importance of Satisfactory Outcome)] , or E(SO) = P(SO)*ISO*

With regard to method persistence, we use E(SOM) and define it as the user's expected value of a satisfactory outcome when he/she is using a method of solving IT problems (e.g. if P(SOM) through self-recovery method is 0.80 and if ISO is 3 in a scale from 0 to 4, then E(SOM) through the method is 2.4). With regard to process persistence, we use E(SOP) and define it as the user's expected value of a satisfactory outcome while he/she is persisting with the whole process of solving the problem.

Considering the contributing factors to method persistence identified, the above discussion, and participants' comments such as the one below, we infer that a user persists in a method of solving

IT problems as long as their expected value of a satisfactory outcome (expected benefit) through this method is greater than their expected cost of achieving it through the method. Otherwise, the user gives up using the method and may persist in solving the problem by switching to another method.

> *"When I started I was thinking that I can achieve a positive outcome, and at some point I started questioning whether I would achieve it. I kept working until I became certain that giving up the current method will save me more money, more time and effort."*

In other words, a user persists with a method of solving IT problems if the following condition remains true:

*Equation 2: P(SOM)*ISO > EMC, or E(SOM) > EMC*

TMP can also be supported by Anderson's (1990) rational analysis of problem solving (PG-C), where P(SOM), ISO and EMC each occupy similar positions to P (probability of achieving a goal when a behaviour is enacted), G (the value assigned to that goal) and C respectively. See the next section for a brief discussion of the differences between TMP and Anderson's theory.

Also, considering the contributing factors to user persistence with the overall process (the entire collective methods) of solving an IT problem, the above discussion and participants' comments such as the one below, a user persists in the overall process of solving the IT problem as long as their overall expected value of a satisfactory outcome (expected benefit) is greater than their expected overall cost of achieving it.

> *"It was worth going through solving that problem. I was pretty hopeful about it and knew that solving the problem and having the document printed would outweigh the effort and time I was spending to figure out what's wrong and solve it."*

In other words, a user persists with the overall process of solving their IT problem (process persistence), if the following condition remains true:

*Equation 3: P(SOP)*ISO > EPC , or if E(SOP) > EPC*

Figure 4.8 illustrates an example of user persistence and the decision points in the overall process of solving an IT problem.

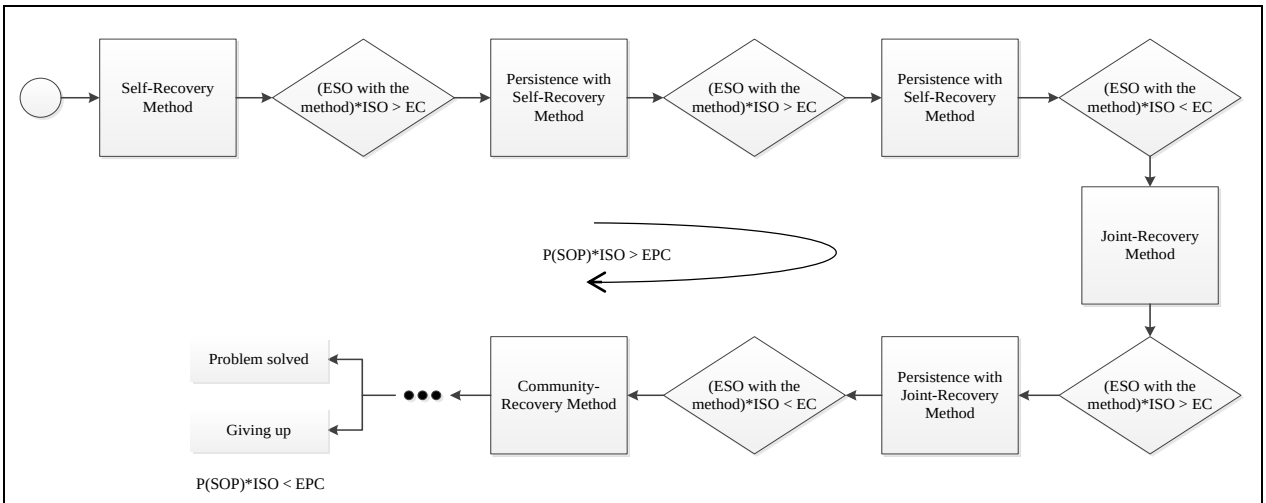

Figure 4.8: An Example of Decision Points within Process Persistence

4.8 DISCUSSION

In this study we focused on IT problems and mentioned that IT problems frequently occur in real-life settings such work and education due to technical reasons, or as a result of mistakes by service staff users themselves. The study considered 'user' as an individual end-user or consumer of an information technology (IT) and 'problem' as an IT problem that occurs for the user in real life, not a task or a problem given to a person as we see in experimental studies and usability testing. We considered service-supported work-and study-related ITs to allow for data-gathering about a range of IT problem-solving methods that a user may employ. The findings and the users' comments clearly show the importance of user persistence when solving their own IT problem and achieving an outcome that is satisfactory to them. The research showed that user persistence is important when the user employs any method of solving the problem. It is important both when the user tries to solve an IT problem alone, and where a full user support service is available. Given the user's significant expectation that they will solve their IT problems, user persistence in solving their own IT problem is of increasing importance for businesses aiming to reduce costs by limiting their user support service. This is particularly important for large workplaces where there are many IT users.

The paper (1) explained the nature of IT problems and the complexity of solving them from the user's perspective; (2) provided a conceptual clarification of user persistence in solving their own IT problem by distinguishing between user persistence with a method of solving IT problems (method persistence) and user persistence with the overall process of solving an IT problem (process persistence), and defined each of these two types of user persistence; (3) identified and presented the factors that contribute to user persistence in solving their own IT problem; (4) developed the Theory of Method Persistence (TMP) to explain why an IT user decides to persist with a specific method of solving IT problems; and (5) developed the Theory of Process Persistence (TPP) to explain why the user decides to persist with the process (the entire collection of the methods) of solving the problem. The study makes an original contribution to IS research, and may potentially make a contribution to theories of problem solving in other disciplines such as psychology and behaviour research.

In order to ensure trustworthiness of the findings, we explained the data collection and analysis processes, presented representative quotations from the research participants, had frequent meetings and open dialogues within the research team, and sought 'member checking' by providing the participants with an interim summary of the results. In addition, we conducted a second round of data collection through a different method (individual interviews), from different participants, and about different events of IT problems to check for consistency and completeness of the findings. Moreover, we used memos and constant comparison (as a part of the grounded theory approach) throughout the analysis of the focus group data. During the analysis of the individual interview data, we took notes and summarised important results, in order to organise our ideas and promote agreement on the results within the research team. Further, several work-in-progress papers were presented to colleagues, peers and experts at various stages of the data collection and analysis of the study. These provided the study with constructive comments and feedback, and no alternative explanation for our findings or opposition to our two theories arose from these presentations. In addition, we sought to minimise any influence from the researcher on user persistence and ensure validity of data by using the critical incident technique and our plan for the individual interviews. These data collection methods allowed us to gather information on user persistence in solving the problems which occurred prior to the participants' attendance in the focus groups and individual interviews.

4.8.1 IMPLICATIONS FOR RESEARCH AND PRACTICE

In this study, we focused on the notion of 'persistence', differentiated between method persistence and process persistence, and developed our two theories of TMP and TPP. Each of the TMP and TPP explains a user's mental evaluation process of their expected benefit and expected cost (EMC in TMP, and EPC in TPP) of solving an IT problem. Our study and its findings also went beyond establishing this evaluation process by (1) identifying the specific factors that contribute to P(SOM) with each method of solving IT problems (see section 5 and Table 4.10 for details), and by (2) identifying the cost related factors while solving an IT problem. With regards to the cost factors of solving IT problems, we emphasise that compared with Anderson's (1990) theory and previous studies of persistence (e.g. Payne and Duggan, 2011) which have considered 'time' as their only measure of cost, our grounded research and choices of research methods (critical incident technique through group discussions and follow up interviews for real-life events of IT problems) supported us to establish that expected cost (in both method and process persistence) can be perceived as the expected time, level of effort and endurance of negative feelings (anxiety and frustration) incurred in solving an IT problem. Identification and inclusion of these cost factors can provide a more accurate measurement of perceived cost; thus, leading to a more accurate study of user persistence. Identification of these cost factors also provides conceptual insights (by providing a more accurate conceptualisation and measurement of expected cost factors) for the theory building studies of problem solving discussed above.

Our findings and theories of user persistence can extend the behavioural conceptualisation of individual-level IT post-adoptive behaviours. We suggest that the four types of problem recovery methods we identified in this study (even the joint- and firm-recovery methods, as they are from the user's perspective and user has some participation - though a low degree – in solving the problem) can be considered within a group called 'user IT problem-solving' in the broad area of IT post-adoptive behaviours. As mentioned, we suggest that this can be regardless of voluntariness use of IT and how recent it has been implemented, as IT problems may occur for users at any time following the installation of IT in both voluntary and mandatory use contexts.

In addition, our findings and theories can particularly extend the theoretical models of user coping and adaptation[27]. As mentioned, to our knowledge, the existing IS literature, with the exception of Ortiz de Guinea and Webster (2011), refers the terms 'IT event' and 'IT interruption' to the implementation/installation of a new IT and significant changes made to an existing IT by an organisation (Louis and Sutton 1991; Lyytinen and Rose 2003), and to date, no user coping and adaptation study has specifically focused on studying IT problems as a user-perceived IT event/interruption. We argue that from a coping and adaption lens, the P(SOM) construct and at least some of the persistence factors (at least some of the persistence factors that contribute to P(SOM) with each of the four methods of problem recovery) are relevant to and have the potential be placed at the secondary appraisal stage of the coping theory (i.e. the stage a user assesses available resources to decide whether to persist with a method of IT problem solving). Therefore, our findings can extend the theoretical models in user coping and adaptation studies by (1) suggesting that perceived IT problems can be considered as an IT event/interruption, and (2) the P(SOM) construct and the persistence factors contributing to the construct can be considered in user's evaluation at the secondary appraisal stage.

According to post adoptive IT studies such as Ortiz de Guinea and Markus (2009) and Jasperson, Carter and Zmud (2005), over time and after users gain experience in using an IT, post-adoptive behaviours become habitualised. For example, a user may only use a specific or a set of IT features unless a significant intervention occurs to disrupt the formation of these deep mental scripts (Jasperson et al., 2005). Although the innovation management literature (e.g. Nambisan, Agarwal and Tanniru, 1999) suggests that user's intentions to explore an implemented IT contributes to learning, there might also be instances in which an IT problem can lead to the user engagement in learning and in 'enhanced use' of IT. Enhanced use (a construct recently conceptualised by Bagayogo et al., 2014) represents novel ways of employing IT features and can have three major forms including using a formerly unused set of IT features, using one or more current features of an IT for additional tasks, and 'features extensions' (which is defined as "extending an IT's features to perform a current or additional task") (Bagayogo et al., 2014, p. 366). Existing studies of user learning and IT feature extension have focused on implementation of a new IT or significant

[27] As mentioned, the concepts of user coping and user adaptation are highly related to each other, to the extent that Beaudry and Pinsonneault (2005, p. 494) conceptualise "user adaptation as coping" and a copying strategy as an adaptation behaviour.

changes made to an existing IT by an organisation as IT events/interruptions. To our knowledge, no user learning and IT feature extension study has specifically focused on the occurrence of a perceived IT problem as a type of IT event/interruption. We argue that the occurrence of an IT problem and user persistence in solving it (e.g. through self-, community- or collaborative recovery) may lead to the user learning and enhanced use of IT by identifying some previously unknown or unused useful IT features and/or a more efficient way of interacting with the IT. We believe that post-adoptive behaviour research can more comprehensively explore the process of user learning and enhanced use by (1) incorporating and paying more attention to perceived IT problems as a type of IT interruptions, and (2) identifying which of the four methods of IT problem recovery we identified in this study can contribute more to this process.

We note that in contrast to "rational inputs" (e.g. perceived usefulness and prior knowledge, Ortiz de Guinea and Markus, 2009, p. 436), emotion (as a cost factor identified in this study) is a "*non-rational"* input (Ortiz de Guinea et al., 2009, p. 436) to a user's *conscious* decision to persist or not persist with solving an IT problem. This means that unlike Anderson's (1990) theory and existing persistence studies (e.g. Payne and Duggan, 2011) which have used the theory, each of the TMP and TPP have considered both rational persistence factors and the irrational factor of emotion/feelings. However, as Anderson developed their theory specifically for the rational analysis in problem solving, we do not claim that our theory extends Anderson's theory. Instead, we believe that identification and inclusion of emotion as a non-rational persistence factor in TMP and TPP can extend our theoretical perspective to problem solving research and shows the potential for developing more comprehensive problem solving theories (though not necessarily with the focus on persistence) that may accommodate both rational and irrational factors.

Post-adoptive IT literature have contradictory views to the role of emotion in post-adoptive behaviours. Ortiz de Guinea and Markus (2009) categorise these views into (1) the view of the researchers, such as Sun and Zhang (2006) and Limayem and Hirt (2003) who believe that emotions, feelings and affect[28] factors contribute to decision (i.e. consciously) to post-adoptive

[28] Affect is conceived and measured as an emotion; however, it is different from emotion in the sense that "affect is a psychological state that entails an evaluative component (e.g., good-bad, like-dislike)... as such, an affect is not necessarily triggered by specific events and often constitutes a background to consciousness and to other mental states" (Beaudry and Pinsonneault, 2010, p. 690).

behaviours (e.g. continuing IT use), and (2) the view of authors such as Carver and Scheier (1981), Mohr (1996), and Spielman, Pratto and Bargh (1988) who believe that emotions drive post-adoptive behaviours directly and user is not consciously aware that their behaviour is affected by their emotions. In this study we identified negative emotions/feelings (anxiety and frustration) as a contributing factor to decision (i.e. consciously) to persist with problem solving and thus, being consciously accessible ('calculable' as part of the 'cost factors' through a Likert scale). Therefore, this finding is contradictory (we view this finding as a true rival explanation) to the second view which expresses that emotions drive user's post-adoptive behaviours directly and unconsciously. Our claim is also supported by Ortiz de Guinea, Titah and Léger (2014) who studied antecedents of user's behavioural beliefs in IS research in their Neuropsychological IS study. They categorised these antecedents into implicit antecedents (automatic and unconscious) and explicit antecedents (perceptual that user is aware of and can report them), and consider frustration and anxiety emotions as explicit factors. We also suggest that expected (user's perceived/estimated) anxiety and frustration emotions along with other expected cost factors (expected time and effort) form each of the expected method cost and expected process cost constructs. In other words, negative emotions (along with other cost factors) cause the two formative constructs of EMC and EPC.

Many of the existing studies on post-adoptive behaviour in IS Use domain have focused on the role of task in acceptance and continuing use of an IT. Some of these studies were done after and based on a call by Benbasat and Barki (2007) who suggested more focused analysis of IS Use in specific task contexts. As pointed out by Bagayogo, Lapointe and Bassellier (2014, p. 370), "these studies usually focus on business tasks" and include "those using the task-technology fit theory (Goodhue, 1995), cognitive fit theory (Vessey and Galletta, 1991), and media richness theory (Dennis and Kinney, 1998)". More specifically, some of these studies, such as Burton-Jones and Grange (2012) have focused on understanding the effective use of IT and impact performance. In this study, we discussed that IT problems are interruptions to users' use of IT while doing their tasks, and positioned our study of user persistence (in solving their own IT problem) for the period of time at which a user is trying to solve the problem following its occurrence (i.e. we considered a question like 'what if an IT problem occurs and interrupts the use of an IT when doing a task?'). As a result, naturally, the role of task and its characteristics (task importance, time criticality, task analysability/difficulty, reliance on IT, etc.) are not apparent in this study because the critical

aspects of task are fully captured in the constructs included in the theory, as we will explain. As explained earlier, there may be several factors that make solving an IT problem important for a user and form the *ISO construct* (i.e. ISO as a formative construct), one of which may be *task importance* which is therefore captured in ISO. In addition, as shown in this paper, ISO can be effectively measured without the need for knowing independently why solving an IT problem is important for the user. However, a focus on studying task characteristics by future research can provide a comprehensive understanding of the role of task in user persistence with IT problem solving.

With regards to studies of motivation-based problem-solving in general (not just in the context of user IT problem-solving), we note that as IT problems frequently occur for users in real-life settings and because we studied IT problems in real-life work and study related situations, we believe that this study has a high potential to extend our theoretical perspective in motivation-based problem-solving in other real-life contexts, as well. Indeed, we believe that the mental evaluation process of TMP and TPP may be adaptable for theory building studies of problem-solving which aim to explain and/or predict the evaluation process an individual goes through to decide whether to persist with solving any real-life problem. This may be particularly useful for the real-life problems for which more than one option/method (e.g. solving the problem by one's own and seeking social support) exist to solve it and the individual is aware of these options. We however clarify that such a framework may not be applicable for the non-motivation based problem-solving studies which aim to develop a process theory that explains and/or prescribes a sequence of steps of problem solving. We suggest researchers of these problem solving processes to see the problem solving process theories, such as Tallman, Leik, Gray and Stafford's (1993) theory, Newell and Simon's (1972) human problem solving theory and creative problem solving processes, such as the ones developed by Cook (1998) and Čančer and Mulej (2013).

Finally, with regards to the implications of the findings for practice, the focus groups and individual interviews show that most student users start with the self-recovery method, but spend less time and effort on solving the problem through this method, switching quickly to a community-recovery method. This is similar for teaching staff, but with a greater tendency toward joint-recovery as their second method, and is in contrast to school administrator IT users for whom

firm-recovery is the most frequent second method. Not only do these general patterns among the participants of this study show the importance of self-recovery efforts (as the first frequent method), but also they show the usefulness of peer support and interactive media (e.g. online discussion forums, Q&A sites) that facilitate the community-recovery method (as the second frequent recovery method). In order to encourage user persistence, we particularly suggest businesses to consider: (1) the importance of providing easy to use and user friendly ITs, (2) the importance of high interactivity capabilities of IT (such an IT provides a big picture of the problem recovery process: informs the type of problem, suggests a solution, shows the current step and guides for next steps of solving the problem, and allows for knowing what will happen if the user decides to do a certain action); (3) enhancing user's control on self-recovery of the problem (if self-recovery of certain problems does not lead to serious problems or potential threats such as a threat for system security, remove any features that limit the user's control on solving the problem); (4) the importance of the quality of self-help information and 'how-to' contents (see the findings section for details and the complete list of self-help information quality factors); (5) and facilitating the interaction between the users (through providing interactive channels and online community of users, such as Q&A sites and online discussion forums specifically about solving IT related problems); and (6) educating the users through their interactions with user support staff (this can improve their technology self-efficacy and can give the required knowledge to solve the same or similar IT problems in future).

4.9 CONCLUSION

We provided a conceptual clarification of user persistence, identified the factors that contribute to user persistence in solving their own IT problem, differentiated between method persistence and process persistence, and built and tested two theories of persistence. Our Theory of Method Persistence (TMP) explains why a user decides to persist in solving their IT problem using a specific method, and our Theory of Method Persistence (TMP) explains why a user decides to persist in the overall process of solving the problem. The study makes an original contribution to IS research, and may potentially contribute to theories of problem solving in other disciplines such as psychology and behaviour research. The section below presents a statement of research

limitations and our suggestions for how future IS research can further investigate the notion of user persistence in solving their own IT problem.

4.9.1 LIMITATIONS

In order to identify as many persistence factors as possible, we invited IT users including university students, teaching staff and administrators to participate by explaining their experiences of IT problem solving in unobserved environments. However, new insights may be revealed by considering participants with a lower level of education and a lower level of perseverance to explain their experiences of IT problem solving in the presence of others.

We note that first, although we emphasised to the participants on the importance of including as much as possible information on the events of IT problems they experience and on how they solved them, there might have been the possibility of some participants' (of individual interviews) non-compliance with the data collection process. For example, not all events of IT problems might have been reported in their notes because of the effort involved and not all details about the steps of solving an IT problem might have been reported. Second, there might have been one or more events of IT problems that one or more participants did not perceive them as IT problems; thus they might have not included them in their notes. We believe that these two possibilities have not been significant risks to this study, because first, there was never an intention to collect every possible event of IT problem, particularly because collecting all possible data about all events of IT problems has not been of any theoretical sensitivity for the study; and second, the study has not aimed to identify the exact steps of solving each IT problem (i.e. for the topic of the thesis, it was enough to know what methods of IT problem solving those steps of problem solving reflect).

The exclusive reliance on user's self-report and retrospective data might generate a risk of insight bias. Once an event happened, people might update their beliefs about their perceived probability of a past event accordingly. We tried to minimise this risk by employing the critical incident technique to gather data about the most memorable events of IT problems and that how they were solved. For future research which aim to test the theories of TMP and TPP, we suggest gathering primary data using the diary method where each user self-reports his or her own decisions, while

trying to solve his or her own IT problem, in a diary format file. We believe that like the critical incident technique, the diary method can support gathering data about real-life events of IT problems and user persistence in solving them in real-life settings where the user is not restricted to a certain amount of time and a certain location (Nili et al., 2014b).

In addition to the risk of insight bias, there could have been the risk of recall bias. The delay between IT events and individual interviews (for which the critical incident technique was not used) could have led participants to forget key events of IT problems or feelings. We minimised this risk by asking participants in our invitation emails and information sheet to take note and send (via email) a description of the event(s) of an IT problem that occurred during the two weeks after agreeing to participate and that how they solved the problem. As explained, they were also informed that these notes will be reviewed by the primary researcher and that they will be used and shown to the participant during the interview. For a more complete confidence in the results about user persistence in solving their own (real-life) IT problems, we suggest future IS researchers to ask participants to contact the researcher right after the occurrence of an IT problem and that the researcher employs experimental methods such as observation and think-aloud method while the participant is solving the problem.

Lastly, we found that solving an IT problem is important for different users for a variety of reasons, such as to avoid the occurrence of a negative work- or study-related result, to achieve a positive work- or study-related result, or might simply just because of the importance of a task for the user. However, in order to focus on the purpose of this study and because we believe that ISO can be measured without the need to know why it is important, we did not aim to identify the factors (e.g. task importance) that make solving an IT problem important for a user, and only asked the participants to mention the extent to which achieving a satisfactory outcome is important for them. What factors influence how important solving an IT problem is can of course be investigated by future IS research.

4.9.2 SUGGESTIONS FOR FUTURE RESEARCH

The critical incident technique has been widely used in individual interviews, but rarely with other methods of data collection. For example, its usage in focus groups has been scarce in decision-making and behaviour research, and this is the first IS study to date that has used the technique for focus groups. Given the infrequent usage of the technique in IS research (Gogan, McLaughlin and Thomas, 2014), we suggest future researchers consider its usefulness for different data collection methods. Also, we note that given suggestions to use the term 'significant' rather than 'critical' and 'event' instead of 'incident' to better clarify the purpose of the technique (Norman, Redfern, Tomalin and Oliver, 1992; Schluter et al., 2008) we used these terms in this study and suggest future IS researchers adopt this.

A good theory building paper suggests future research how to measure the constructs, as well. In order to measure ISO, we suggest the question "to what degree a satisfactory outcome is important for you?", and in order to measure P(SOM) and P(SOP), we suggest modifying the question "how likely did you think it would be you would reach a satisfactory outcome?" for each of P(SOM) and P(SOP). We suggest that EMC can be measured through calculating the average of the answers (e.g. using a scale ranging from 'nothing' to 'very high') of the question "how much …. did you think you would need to achieve a satisfactory outcome?" for each of the cost factors. We also suggest that EPC can be measured through the question "How would you rate the overall cost (e.g. time and effort) of solving this problem?" which can be answered through a scale ranging from 'nothing' to 'too high'. Unlike each of E(SOM) and E(SOP) which consists the two factors of ISO and probability of a satisfactory outcome (i.e. P(SOM) for method persistence and P(SOP) for process persistence), each of EMC and EPC was identified as one factor; therefore, the question consists both probability and value/amount aspects. We however note that these suggested questions may only help to operationalise and measure the constructs of the two theories. In order to test the two theories, future research may need to consider designing a questionnaire in which each of these suggested questions can be revised for each of TMP and TPP. Also, future research may consider each of the above questions (there also may be a need to slightly revise the wording of each question) for the start, middle and the end (or possibly more decision points) of each method of IT problem solving a user used to solve an IT problem. At this stage, we expect that

P(SOM)*ISO is greater than EMC at the start and middle of using each method, and is lower than EMC at the end of using that method. We also suggest that the interview, survey, etc. protocol should be designed in a way that is flexible enough for testing TPP (where a user uses more than one method of IT problem solving).

In this study we did not aim to measure the strength, level or degree of user persistence or study the degree to which persistence leads to user success or effectiveness in solving an IT problem. However, for studies in this area, we suggest considering the time spent for the overall process, number of methods used and number of decision points (to continue or quit) within the entire process for a more accurate measurement of levels of user persistence and the investigation of the relationship between persistence and overall success in solving the problem.

Future research can also consider a deep study of each of the persistence factors groups identified in this paper. An example could be a detailed study of the IT quality factors from a human computer interaction perspective with a focus on situation awareness. Moreover, the quality of the community of users can be examined through study of the emotional support a user receives when trying to solve an IT problem, measurement of the quality of information received through the community (a recent example is Sun et al. 2015), the factors affecting participation in these communities, etc. Moreover, we suggest future researchers consider studying the quality of joint IT problem solving. This is particularly important in the multi-channel service environments, as consistency/integrity of information and processes during the interactions between users and user support service staff are of high importance.

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APPENDIX 4.1

Analysis of the Factors Identified in the e-Service Recovery Studies, System Quality Studies, and Information Quality Scales

Factor	Source	Definition	Selected / Excluded? Why?
Interactivity	Zhu et al. (2013)	User's perception of how well a system responds to commands and how easily it enables arrangement of the amount, sequence and style of presented information (i.e. how well and how easily a user can interact with a system while using it).	Selected: according to this definition, a user's perceived interactivity of an IT is relevant to the context and purpose of this study and may be relevant to the period of time (after the "first click") at which a user is trying to solve an IT problem.
Attribution	Zhu et al. (2013); Dabholkar and Spaid (2012); Robertson et al. (2012); Hui and Toffoli (2002)	An individual's attribution of an event or the reason of a problem totheir own actions (internal attribution) or to external factors such as other people or technology (external attribution).	Excluded: the authors have explained that by attribution they mean attribution of blame (i.e. who has caused the problem, is responsible for the problem, or could have prevented the occurrence of it?). According to this explanation, this factor is relevant to the notion of user persistence and to the context of this study. However, the factor has been already selected in section 4.1 (see Table 4.1).
Perceived Control over technology	Zhu et al. (2013)	The extent to which a user believes that they have the ability to adapt to the IT and direct it.	Excluded: according to this definition, this factor is covered by the concept of Perceived Behavioural Control (a user's perception of their ability to perform a behaviour such as using an IT, solving an IT problem, etc.).
Perceived Controllability (over the cause of failure)	Choi and Mattila (2008); Hui and Toffoli (2002)	User's perception of whether the occurrence of failure is under the control of the firm, under their own control, or because of other circumstances which are not under the control of a firm or their own control. Therefore, if for example a user realises that the firm could have prevented the failure, they attribute the failure to the firm.	Excluded: according to the definition of this type of controllability (i.e. over the cause of failure), this factor is covered by the concept of attribution of failure/problem.
Competitive Information	Zhu et al. (2013)	"The amount of factual or evaluative information provided about competitive offerings" (p. 18).	Excluded: is irrelevant to the context of this study.

Customer/User-Recovery Expectancy	Zhu et al. (2013)	An individual's estimation of the possibility that a technology problem can be eventually resolved by ones' own or other's actions	Excluded: according to this definition, this factor is relevant to the notion of user persistence and to the context of this study. However, it is covered by the concept of 'probability' factor which had been already selected in section 4.1 (see Table 4.1).
Customer-Recovery Effort	Zhu et al. (2013)	User's perceived level/amount of effort while they are trying to solve the problem.	Selected: is relevant to the notion of persistence and to the context of this study.
(user's perceived amount of recovery) Effort	Zhu et al. (2013)	When a user seeks and applies alternative actions to solve a problem. This needs diagnostic thinking and active learning while they are persisting in solving the problem.	Excluded: employing different strategies of problem solving can be considered as a part of user's efforts in solving the problem (even if the user is solving the problem through their own efforts, or while trying to solve a problem jointly with service staff, or…). This factor is excluded for the purpose of parsimoniousness.
Distributive justice	Folger and Cropanzano (1998); McColl-Kennedy and Sparks (2003); Sabharwal, Soch and Kaur (2010); Robertson et al. (2012)	The perceived fairness of the tangible outcome of what a firm offers to pacify an offended customer to recover from service (e.g. compensation such as refunds, discounts, apologies, replacements and coupons).	Excluded: Distributive justice has an effect on the user's post recovery satisfaction and behaviour, not on their persistence in solving the problem (i.e. not during the problem recovery).
Procedural justice	Folger and Cropanzano (1998); McColl-Kennedy and Sparks (2003); Sabharwal, Soch and Kaur (2010); Robertson et al. (2012)	"Procedural justice is the perceived fairness of the process through which ends are achieved". It encourages the continuation of productive relationships (Sabharwal, et al., 2010, p. 128).	Selected: is relevant to the period of time during which the user and a service employee are trying to solve the problem.
Interactional Justice	Folger and Cropanzano (1998); McColl-Kennedy and Sparks (2003); Sabharwal, Soch and Kaur (2010); Robertson et al. (2012)	"Interactional justice is the extent to which customers feel that they have been treated fairly while personally interacting with the employees of company while going through the recovery process" (Sabharwal, et al., 2010, p. 129).	Selected: it applies to the period of time during which the user and a service employee are trying to solve the problem via an interactive channel of communication.
Severity of problem	Sabharwal and Soch (2011); Robertson et al. (2012)	User's perceived extent of the problem.	Excluded: 'severity of the problem' is highly relevant to 'gain' factor (perceived importance of achieving a satisfactory outcome when trying to solve it). The relationship between these two factors is not examined in this study, and we only consider

			'gain' for the purpose of parsimoniousness.
Responsiveness (of IT)	Akinci, Atilgan-Inan and Aksoy (2010); E-RecS-Qual (by Parasuraman, Zeithaml, Malhotra, 2005)	How fast and easy an IT responds to a user's request.	Excluded: this factor is covered by the concept of 'interactivity' factor.
Compensation	Akinci et al. (2010); E-RecS-Qual (by Parasuraman et al., 2005); Robertson et al. (2012)	E.g. refunds, discounts, apologies, replacements and coupons to compensate a service problem.	Excluded: this is relevant to the post-recovery stage, not to the period of time involved in solving a service problem.
Contact	Akinci et al. (2010); E-RecS-Qual (by Parasuraman et al., 2005)	The availability of contact information (e.g. on a website) to reach staff and the availability of service staff for service problem recovery.	Excluded: "contact" is too broad. The availability of service staff and reaching them easily is covered by the procedural and interactional justice.
Online Self-Help Information	Kasabov and Warlow (2010); Kasabov (2010)	Online self-help information (available via an online self-service system such as a website) for a system (not a troubleshooting feature of a software, etc.) provided by the business for customers, so that a user is able to access this online information to solve the problem by their own efforts.	Excluded: The importance of the availability and quality of self-help and how-to information has also been sated by recent practitioner articles such as Forbes.com (2014). This factor is important, is relevant to the purpose and context of this research, and may contribute to user persistence in solving their own IT problem. However, it is too broad and covers many other factors.
Service guarantee	Robertson et al. (2012)	The availability of multiple attribute-specific guarantee in case a service failure occurs.	Excluded: the paper has studied the relationship between a multiple attribute-specific guarantee and users' intentions to voice their complaints (not its relationship with recovery efforts, persistence, etc.).
Personalised response	Robertson et al. (2012)	A personalised response from service staff to a user about solving a service problem.	Excluded: is covered by the concept of interactional justice
Promptness and problem solving	Mostafa, Lages and Sääksjärvi (2014)	How quickly a service employee responds to a customer	Excluded: as the paper explains, it is covered by the concept of procedural justice.
Apology	Mostafa, Lages and Sääksjärvi (2014)	Service employee's apology for occurrence of the problem.	Excluded: as the paper explains, it is covered by the concept of distributive justice.
Facilitation (of complaints)	Mostafa, Lages and Sääksjärvi (2014)	Making complaint easier for a dissatisfied user	Excluded: it is about user's complaining behaviour, and not about their persistence during solving the problem.

Effort (service employee's effort)		Service employee's effort to handle the complaint. The user perceives this effort as a fair interpersonal treatment.	Excluded: it is covered by the concept of interactional justice/fairness.
Factors Related to the Quality of System			
Usefulness	Moore and Benbasat (1991), You and Donahue (2001), Bhattacherjee, (2001), Barnes and Vidgen (2002)	The degree to which a user believes that using the system enhances his or her job performance.	Selected: usefulness is relevant to the purpose of this study, may be relevant to the period of time (after the "first click") at which a user is trying to solve an IT problem and may contribute to user persistence in solving the problem.
Ease of Use	Yoo and Danthu (2001), Barnes and Vidgen (2002), Gable, Sedera and Chan (2008)	The degree to which a user believes that using the system would be free of effort.	Selected: perceived ease of use of a system is relevant to the purpose of this study, may be relevant to the period of time (after the "first click") at which a user is trying to solve an IT problem, and may contribute to user persistence with their efforts of solving the problem.
Reliability/ Fulfillment	Zeithaml (2002), Delone and McLean (2003), Wolfinbarger and Gilly (2003), Parasuraman et al (2005), Nelson, Todd and Wixom (2005)	The degree to which the technology fulfills its purpose	Excluded: in the context of solving IT problems, a perceived IT problem/failure has already occurred for a user (i.e. from the user's perspective, the system has not been efficient enough in fulfilling its purpose); This factor is unable to explain persistence during the period of time at which the user is trying to solve an IT problem.
Security	You and Donahue (2001), Wolfinbarger and Gilly (2003), Parasuraman et al. (2005)	The degree to which the system, information and services are protected from unintended or unauthorized access.	Excluded: user's perceived security of a system is not relevant to the context of user persistence and to the purpose of this study. It is relevant to preventing IT problems, but it is not relevant to the period of time (after the "first click" of problem recovery) at which a user is trying to solve an IT problem.
Responsiveness	Zeithaml (2002), Delone and McLean (2003), Nelson et al. (2005), Parasuraman et al. (2005)	The response time of the system while it is being used and receives commands.	Excluded: is covered by interactivity (see the first row of the table for the definition of system interactivity) and usability factors.
Efficiency	Zeithaml (2002)	The ease and speed of accessing the system	Excluded: according to this definition, this factor is explained and covered by other dimensions such as Ease of Use.

Availability	Delone and McLean (2003), Yang et al. (2005), Parasuraman et al. (2005)	The availability of a specific system (which is necessary to access an e-service) for a user.	Excluded: a user who is trying to solve an IT problem has already access to that IT.
Accessibility	Yang et al (2005), Nelson et al. (2005), Parasuraman et al. (2005)	User's perception of how fast and easy it is to access all parts (e.g., web pages) of a system.	Excluded: according to the definition of system accessibility, this factor is covered by the concept of perceived system interactivity (see the first row of the table for the definition of system interactivity).
Entertainment	Barnes and Vidgen (2002), You and Donahue (2001)	The visual appeal, innovativeness and flow-emotional appeal.	Excluded: according to the definition, this factor is clearly irrelevant to the notion user persistence and to the context of this study.
Flexibility/ Customisation	Nelson et al. (2005)	The degree to which a system allows a user to customise and personalize its parts based on their preferences and needs.	Excluded: according to the definition of system flexibility (customization), this factor is clearly irrelevant to the notion user persistence and to the context of this study.
Usability	Delone and McLean (2003)	User's perceived ease of use and learnability of a system, and its usefulness and efficiency in achieving a specific purpose.	Excluded: this is a too broad concept. It covers several concepts, such as usefulness, efficiency and ease of use.
Adaptability	Delone and McLean (2003), Marchetti, Pernici and Plebani (2004), Sousa and Voss (2006)	The system can tune itself based on change in network or consumer needs.	Excluded: it is a requirement for system interactivity and responsiveness; however, it is irrelevant to the notion user persistence and to the context of this study.
Factors Related to the Quality of Self-Help Information on Solving an IT Problem			
Availability	Lee et al. (2002); Bovee et al. (2003); Katerattanakul and Siau (1999)	The availability of self-help information on solving IT problems. This information is produced by a business for users and may be available in different formats (an online text file, a downloadable video, etc.)	Selected: 'availability' of self-help information on solving IT problems may contribute to user persistence in solving an IT problem. This factor is relevant to the purpose and context of this study.
Accessibility	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011); Katerattanakul and Siau (1999)	The available information is fast and easy to access for the user.	Selected: user's access to self-help information is relevant to the purpose of this study and may contribute to user persistence.
Relevancy	Lee et al., (2002; Bovee et al. (2003); Ge et al. 2011; Herrera-Viedma et al. (2006)	The degree to which the available self-help information is relevant to solving a specific IT problem.	Selected: 'relevancy' of self-help information to solving a particular IT problem is relevant to the purpose of this study and may contribute to user persistence.

Integrity	Ge et al. (2011)	Data is not altered or damaged because of a system error, since the last authorised access.	Excluded: 'integrity' is relevant to data quality (not information quality) and data exchanges among users, departments at an organisation, etc.
Timeliness / Currency	Lee et al., (2002); Bovee et al. (2003); Ge et al. (2011); Herrera-Viedma et al. (2006); Klobas (1995)	The information is up to date (e.g. is for the latest version of a software or application).	Selected: 'timeliness / currency' of self-help information on solving an IT problem is relevant to the purpose of this study and may contribute to user persistence.
Accuracy	Lee et al. (2002); Bovee et al. (2003); Klobas (1995); Todoran, et al. (2015); Arazy and Kopak (2011); Stvilia, Gasser, Twidale and Smith (2007); Katerattanakul and Siau (1999)	Correctness of the available information on a particularly IT problem.	Selected: 'accuracy' of self-help information on solving a particular IT problem is relevant to the purpose of this study and may contribute to user persistence.
Completeness	Lee et al. (2002); Bovee et al. (2003); Herrera-Viedma et al. (2006); Todoran, et al. (2015); Arazy and Kopak (2011); Stvilia, Gasser, Twidale and Smith (2007)	The thoroughness and comprehensiveness of information. E.g. an online text file/instructions includes all relevant steps to solve an IT problem.	Selected: 'completeness' of self-help information on solving an IT problem is relevant to the purpose of this study and may contribute to user persistence.
Consistency (Consistent Representation)	Lee et al. (2002); Bovee et al. (2003); Arazy and Kopak (2011); Katerattanakul and Siau (1999); Stvilia, Gasser, Twidale and Smith (2007)	Consistency in format, style and presentation of information and consistency of the content available via different channels (e.g. text on a website, a downloadable text file or an online instructional video)	Selected: 'consistent representation' of self-help information on solving an IT problem is relevant to the purpose of this study and may contribute to user persistence.
Conciseness (Concise Representation)	Lee et al. (2002); Herrera-Viedma et al. (2006); Arazy and Kopak (2011)	Appropriate amount of information. Not too much and not too little.	Selected: 'concise representation' of self-help information on solving an IT problem is relevant to the purpose of this study and may contribute to user persistence.
Redundancy	Stvilia, Gasser, Twidale and Smith (2007)	The degree to which the information is new and informative. It does not include repeated elements / duplicates.	Excluded: 'redundancy' was considered as an information problem (and only by one paper which focuses on information problem: Stvilia et al., 2007), not as a measure of information quality. High quality information (that covers quality factors) are free of redundancy.

Appropriate Amount	Lee et al. (2002)	Appropriate amount of information: not too much and not too little.	Excluded: it is identical to the concept of 'concise representation' of information.
Security	Lee et al. (2002); Bovee et al. (2003)	Defending information from unauthorised access, disruption, use, modification, destruction and/or recording.	Excluded: these two factors are more relevant to data quality and data exchanges (e.g., data exchanges among users or departments at an organisation). Also, information security is concerned with confidentiality of sensitive information and where privacy is important for a user or business (not information about how-to solve an IT problem).
Ease of Manipulation	Lee et al. (2002); Ge et al. (2011)	How easy it is to use the available information for a purpose.	
Understandability	Ge et al. (2011); Herrera-Viedma et al. (2006)	The information is provided in such a way that a user with a reasonable knowledge of IT and the willingness to solve an IT problem, should be able to comprehend it.	Selected: 'understandability' of self-help information on solving an IT problem is relevant to the purpose of this study and may contribute to user persistence.
Ease of Understanding	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011); Arazy and Kopak (2011)	The information is easy to comprehend.	Excluded: these factors have the same concept and are identical. 'Understandability' has been selected as an appropriate label for all of these three factors for the purpose of parsimoniousness and because of the comprehensiveness of the label. 'Interpretability' has also shown a cross loading with 'ease of understanding' in Lee et al.'s (2002) study.
Interpretability	Lee et al. (2002); Bovee et al. (2003); Ge et al. (2011)	The comprehensibility or understandability of information.	
Objectivity	Lee et al. (2002); Ge et al. (2011)	The absence of bias or any possibility of alternative interpretation.	
Originality	Herrera-Viedma et al. (2006)	The information is new or novel. It is reliable and can be distinguished from reproductions, derivative works, etc.	Selected: We agree with Lee et al. (2002) who state that a user considers original information with a good reputation as reliable information. Therefore, these three factors are selected; however, we consider them in the sub-group of "information reliability", as they altogether convey the reliability of information.
Believability	Lee et al. (2002); Herrera-Viedma et al. (2006)	The extent to which a user can believe and trust the information provided forthem.	
Reputation	Lee et al., (2002)	The extent to which the information is from a reputable and credible source.	
Reliability	Ge et al. (2011); Todoran, et al. (2015)	The extent to which a user believes that they can rely on the source of the information and, therefore, the information itself. Reliable information is believable, sure, authentic, original and genuine, and reputable.	Excluded: this factor is relevant to the purpose of this study and may contribute to user persistence. However, we have already considered 'reliability' as the name/label of the group comprising originality, believability and reputation factors (it has not been considered as a separate factor).

APPENDIX 4.2: The Significant Events of IT Problems Identified through the Focus Groups

The Distinct Significant Events of IT Problems Identified through the Focus Groups with Users
Significant Events Identified through the Focus Group with Teaching Staff (Users):
Transferring sound files from my recorder to my computer was not possible.
After a new install my PC got slow and its temperature was rising from 55 to 85 degrees.
I could not add students' email addresses to the learning management system after the upgrade.
VStream did not record my session.
Videos of lectures (via VStream) could not be uploaded into the learning management system.
I couldn't put users into groups (via Blackboard) for the tutorials.
I copied everything on a drive of my PC onto my hard drive (to have a backup), but later I couldn't see (on any computer) any of the things that I copied.
The search function of Blackboard was not working well.
My drive was override by the old files. It did not allow recover and use the file I need.
My (online) drive did not (denied) store any electronic file.
I lost information on a disk.
All the information on my Outlook calendar disappeared.
The Wi-Fi printer was not working (was disconnecting from my computer).
My PC was not accepting (name of a software) download.
The video clips (during presentation) had no sound.
The software was not installing.
Significant Events Identified through the Focus Group with Student (Users):
I logged into my computer in the office room, but my files (which had been saved on the desktop a few months before) were not on the desktop anymore.
I swipe my ID card (to enter computer lab) several times, but each time access was denied.
I logged in to Blackboard, but I did not have any access to the files for my course.
I had no access to the University's Wi-Fi via my smart phone.
The check-out machine of the library was not working, like it was off. I could not turn it on.
Error in 'date' of receiving a product when I ordered it online.
The contents (text like symbols, letters, etc.) of the files that I downloaded from Blackboard via my Mac laptop were not exactly like the original text.
Files cannot be downloaded via my IPad at all.
Significant Events Identified through the Focus Group with Administrators, Students and Teaching Staff (Users):
Administrator 1: I was having issues with Excel documents; they just wouldn't open.
Administrator 1: My computer had a problem with roaming profile and finally got corrupted.
Administrator 2: The piece of work (assignment) disappears once I sent feedback to author.
Administrator 2: once I had checked assignments via Blackboard and I had provided quite a lot of details, those details (feedback) disappear.
Student 1: While scanning a document, it asked for server address, that is a rare occasion.
Student 1: While signing up to tutorials via SCubed, it crashed.
Student 1: Each time I changed the language of my (a MS office tool), it looks like before again.
Student 2: I wanted to submit my assignment via Blackboard, but it couldn't be uploaded (the system did not have any reaction and none of the buttons were working).
Student 3: I decided to print my file, but there was no Wi-Fi because the server was down.
Student 3: my laptop was not charging.
Student 4: I tried to enter my password to log into my computer at the campus, but it did not work.
Student 5: when I tried to open Nvivo, I realised that all of my files are missing.
Student 5: One of my monitors (out two monitors) was blinking. It was happening randomly.
Student 6: I had no access to my email via the University's website.
Teaching staff 1: I get the computer to remember password, but the password that I've carefully remembered on my own computer did not work anymore.
Teaching staff 1: My computer has problem with my roaming profile.
Teaching staff 2: The comments I was adding to a file disappeared and stick at the bottom of the page.

APPENDIX 4.3: The IT Problems Identified through the Diary Method & Individual Interviews

The IT Problems Identified through the Diary Method and Individual Interviews with Users
The IT Problems Mentioned by Teaching Staff:
I had no access to my Outlook email through any device at home after the migration to Office 365.
After relocating my office room, my printer was no longer recognised by my system.
When I opened Echo 360, the software was not working.
The desktop speakers did not work when I had a video conference meeting.
Although a set of speakers were connected to the laptop, the sound is from the inbuilt speakers.
The icon of a software was not appearing on the desktop.
The Outlook settings on my tablet could not be reset.
Outlook wouldn't connect to my account when I log in to my PC in the office room.
I had no access to my search saves in my library profile.
After a change in hosting the email server, I was receiving messages delayed.
I continued receiving silent voice messages in my inbox.
My surface tablet could not authenticate the user.
The search results page (of the library database) does not allow placing intersite order.
Problem of linking my laptop to the WI-FI modem at home.
Problem with my PC booting up. It failed to start Windows.
The IT Problems Mentioned by Students:
The modem does not work and no device can connect to the internet.
Printer does not work after changing the toner.
Smart phone froze and could not be used for the study purpose in class.
An educational YouTube video of a course stopped and could not be replayed.
Computer refused to acknowledge it was connected to WI-FI, despite the icon showing full signal.
The University's learning management system went down while submitting an assignment.
My laptop did not appear to be able to connect to WI-FI at the university campuses.
I had assignment work to complete, but my iMac frequently froze and became unusable.
The wireless mouse on my computer was not responding to movement.
I commanded Adobe Reader to print a document, but the printer was doing nothing.
I tried to connect my iPhone to the VUW network, but I could not see the network.
The login page would not automatically come up when trying to use VPN.
I tried to use ID card scanner at printer, but it showed error message 'Invalid'.
The laptop shut down and could not be booted anymore.
MS Word 2013 froze while working with it and I was scared of losing the much work I had done.
The wireless network card driver of my laptop had a problem and was unable to detect any signal.
My laptop often displays a blue screen then crash dump.
Tablet disconnects from the network when moving it slightly, though it is in the network range.
I cannot download the add/drop course form from the learning management system.
The group video feature was not accepting my request to be invited.
The PC in the post-experiment lab cannot connect to printer.
My smart phone does not connect to the VPN (of library network).
The printer of the lab cannot print colour the slides.
My mobile phone does not open the sound file that recorded lecture.
My laptop slows down when I use some types of software. It did not have this problem.
My webcam shows a much smaller photo of the user.
Only a few number of users can download data, though the network was not set for this purpose.
The IT Problems Mentioned by School Administrators:
I could not access the workforce management system. My log in did not work to check my roster, etc.
Access to website Dreamweaver files (a public VUW-hosted site) denied.
Outlook not starting up.
Access to a course site was denied.
When attempting to access a website from "favourites" saved on my PC, the site was not opening.

The server on the work computer system won't connect to the main server.
Problem booking meeting rooms (Unable to book rooms and see if available).
M drive connection missing. M Drive has most of folders I use in it.
Outlook does not connect to proxy server.

Chapter 5

TESTING THE THEORY OF METHOD PERSISTENCE AND THE THEORY OF PROCESS PERSISTENCE

Abstract: Information Technology (IT) problems frequently occur in real-life situations such as in work, education and businesses. From the user's (or consumer's) perspective, their persistence in solving the problem contributes to achieving a satisfactory outcome, and from the organisational perspective, such an outcome is important for maintaining their customer satisfaction and retaining their customers. In our previous work, we distinguished between user persistence with a specific method of solving IT problems and user persistence with the overall process (collective methods) of solving an IT problem, and developed the Theory of Method Persistence (TMP) and the Theory of Process Persistence (TPP). In this study, we used the diary and individual interviews methods in tandem to test our two theories. The results of our data analysis confirmed both TMP and TPP. A discussion of the findings, an explanation of the research limitations, and our suggestions for future research are also presented.

Keywords: Theory of Method Persistence, Theory of Process Persistence, theory testing, IT problem solving, persistence.

5.1 INTRODUCTION

IT problems frequently occur in real-life settings such as in work, education and businesses, due to technical reasons, service staff or the users' own mistakes (Dabholkar and Spaid 2012; Nili, Tate and Gable, 2014; Zhu, Nakata, Sivakumar and Grewal, 2013). From the user's perspective, their persistence in solving the problem contributes to achieving a satisfactory outcome, and from the business perspective, such an outcome is important for maintaining their user satisfaction. These two perspectives clearly show the importance of user persistence in solving their own IT problem. In our previous work (see the previous chapter) we developed the Theory of Method Persistence (TMP), which explains why a user decides to persist with a specific method when solving an IT problem, and developed the Theory of Process Persistence (TPP), which explains why the user

decides to persist with the overall process (collective methods) of solving the problem. In this study, we empirically tested our theories of TMP and TPP.

In our previous work, we indicated that from the user's perspective, IT problems are unpredictable, there is frequently no clear description and no apparent or immediately available solution for them. As a result, the process of solving an IT problem may be spread over a considerable period of time and frequently includes the use of more than one method when IT problem solving, including self-recovery, community-recovery, joint-recovery and firm-recovery.

Self-recovery is where the user tries to solve the problem only through their own efforts and without any interaction (two way communication) with other users and/or user support staff. In this method, the user may use the self-help information such as online-instructions and FAQs that has been provided by the business, and may use any information already available on the web, such as the conversations of other users about a particular IT problem on a discussion forum. Community-recovery is where the user interacts with one or more other users and asks them for help. The interaction between the users could be in an offline/physical environment or via any channel such as telephone, email, a discussion forum, and a social media platform that facilitates the creation of an online community of users. The online community could be created by users themselves or by the business for the users (e.g. a users' discussion forum which is a part of the business' website). In the joint-recovery method, the user and user support staff try to solve the problem jointly/collaboratively. The interaction between the user and user support staff could be in an offline environment or via any channel such as email, telephone, instant messaging, and social media. Lastly, firm-recovery is where nearly all of the problem recovery is performed by the user support staff and the user's role is limited to reporting the problem and/or checking the outcome.

In our previous work, we distinguished between user persistence with a method of solving IT problems (method persistence) and user persistence with the overall process of solving an IT problem (process persistence). We defined method persistence as "a decision to continue to pursue a goal using the same method when confronted with a perceived obstacle", and defined process persistence as "a decision to continue to pursue a goal using any combination of possible methods

of solving the problem when confronted with perceived obstacles". These definitions became the basis of developing the two theories of TMP and TPP.

TMP and TPP were empirically derived in our previous work, where TMP was developed to answer why a user decides to persist with a specific method of solving IT problems, and TPP was developed to answer why the user decides to persist with the overall process (collective methods) of solving the problem. These two individual level theories were developed based on a study which used the critical incident technique (Flanagan, 1954) through focus groups with IT users. In this work we test the robustness of these two theories by applying a completely different empirical method.

The remainder of the paper is structured as follows. First, we present the theoretical background and a brief overview of TMP and TPP. Next, we describe the research methods we employed, and the way we used them, to test these two theories. This is followed by the presentation of the findings, and the discussion and conclusion sections.

5.2 THEORETICAL BACKGROUND

Both the TMP and TPP are process theories which focus on the notion of user persistence. This section clarifies the process nature of these two theories. Process theories consider the input-process-output concept (Littlepage, Schmidt, Whisler and Frost, 1995; Volkoff and Strong, 2013; Waring, 1996), and differ from each other in terms of their aim and level of scrutiny. They may aim to explain an evaluation process and/or to predict a behaviour, or they may have a higher level of scrutiny with which they aim to explain and/or prescribe a sequence of steps to produce an outcome (Burton-Jones, McLean and Monod, 2014; Gregor, 2006). Most persistence related theories such as Expectancy Theory (MacCorquodale and Meehl, 1953) and Anderson's (1990) Theory, as well as a number of motivation process theories (e.g. Equity Theory; Adams, 1963, 1965) aim to explain an individual's evaluation process of an input. For example, Expectancy Theory highlights the process of an individual's evaluation of amount of effort (e.g. their amount of work and responsibility) for an outcome (e.g. a reward, such as an increase in their salary). It explains and predicts that the individual chooses to put more effort to achieve the outcome, if they

perceive that it is worth the effort. Another example of such a process theory is suggested by Equity Theory (Adams, 1963, 1965). The theory explains and predicts that if, for example, an employee perceives that the output/input ratio of their reward/effort is less than reward/effort ratio of their fellow workers, then the individual is likely to be distressed and endeavour to bring about equality of effort for all employees[29]. Each of the TMP and TPP are expressed as the first type of process theory – that which aims to explain a user's evaluation process following an input. However, in arriving at the final, parsimonious theories, a deeper level of scrutiny, analysing the steps involved in persisting with digital service problem solving, was carried out. In the next section, we present an overview of the two process theories of TMP and TPP.

5.3 OVERVIEW OF TMP AND TPP

TMP and TPP were empirically developed based on a study which used the critical incident technique through three focus groups with the teaching staff, students and school administrators of a large New Zealand research university. Individual interviews with these three groups of users were also conducted for the purpose of triangulation and ensuring the reliability and trustworthiness of the findings. The study considered the work and study related ITs for which user support service was available. The use of the methods and the type of ITs considered in the study led to gathering data about a range of IT problems that happen in real life situations.

According to TMP, "a user persists in a method of solving IT problems as long as their expected value of a satisfactory outcome (expected benefit) through this method is greater than their expected cost of achieving it through the method. Otherwise, the user gives up using the method and may persist in solving the problem by switching to another method". In other words, the user persists with a method of solving IT problems, if the following condition remains true:

*P(SOM)*ISO > EMC, or if E(SOM) > EMC*

[29] The theory is represented through the equation:

$$\frac{\text{Outcomes}_A}{\text{Inputs}_A} = \frac{\text{Outcomes}_B}{\text{Inputs}_B}$$

where P(SOM) is the user's perceived probability of achieving a satisfactory outcome (i.e. probability of a satisfactory outcome) through a specific method. Importance of a satisfactory outcome (ISO) is defined as the perceived value the user assigns to the satisfactory outcome of solving their own IT problem. E(SOM) *or* P(SOM)*ISO is the user's expected value of a satisfactory outcome when they persist with the method, and expected method cost (EMC) is the user's expected cost of solving the problem including the expected amount of time, effort, money and expected negative feelings, including anxiety and frustration through the use of the method. Figure 5.1 illustrates an example of user persistence with the self-recovery method.

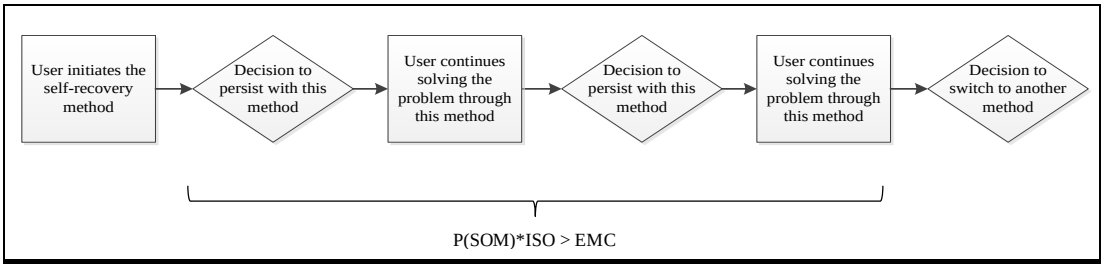

Figure 5.1: An Example of Method Persistence in solving an IT Problem

According to TPP, "[the] user persists in the overall process of solving the IT problem as long as their overall expected value of a satisfactory outcome (expected benefit) is greater than their expected overall cost of achieving it". In other words, the user persists with the overall process (collective methods) of solving their own IT problem, if the following condition remains true:

*P(SOP)*ISO > EPC , or if E(SOP) > EPC*

where P(SOP) is the user's perceived probability of achieving a satisfactory outcome (i.e. probability of a satisfactory outcome) while he/she is persisting with the whole process (collective methods) of solving the problem, and expected process cost (EPC) is the overall expected cost of persistence in solving the problem. Also, E(SOP) *or* P(SOP)*ISO is the user's expected value of a satisfactory outcome when they persist with the whole process (collective methods) of solving the problem. Figure 5.2 illustrates an example of user persistence and the decision points in the process of solving the problem.

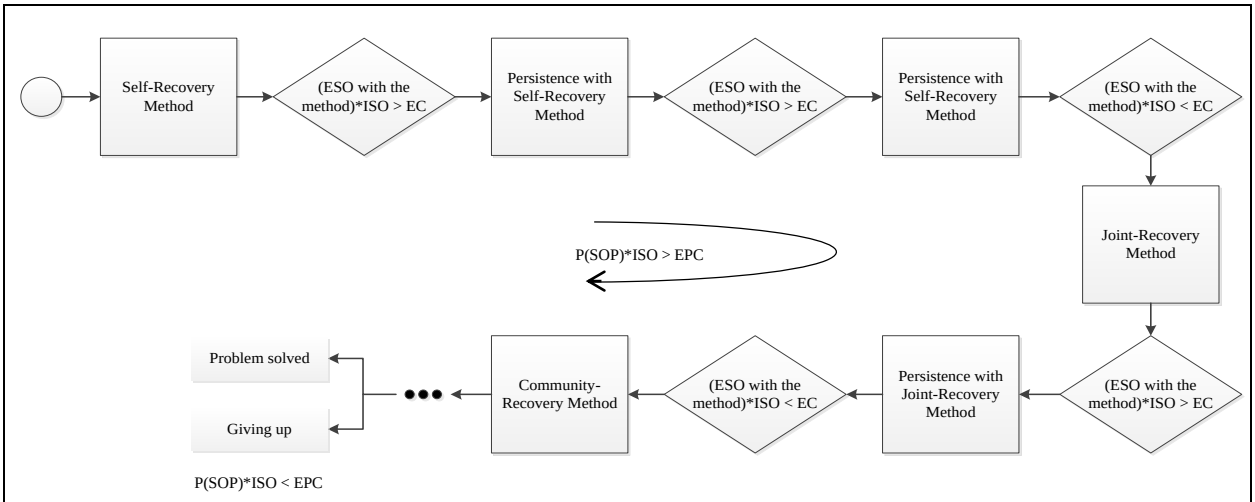

Figure 5.2: An Example of Decision Points within Process Persistence

5.4 METHODOLOGY

In order to test the two theories, we used the diary method (where each user self-reports their own decisions while trying to solve their own IT problem in a diary format file) followed by an individual interview[30] with each user who sent us their diary. The diary method aimed to identify the methods each user employed, and the sequence of those methods (the overall process) the user went through to solve their own IT problem. Each user's diary provided the platform for the interview with that user, where we used a questionnaire to obtain quantitative data to test both TMP and TPP. The use of these data collection methods and our designed diary and individual interview protocols received approval from the Human Ethics Committee of Victoria University of Wellington prior to the data collection. The rest of this section first, presents a background to the diary method; second, it presents detailed information on how we planned and conducted the data collection through the diary method, and; third, explains that how the data we obtained through the method was used in the individual interviews.

[30] I note that the individual interview questions includes two parts. Question 1 to Question 5 obtain qualitative data, and Question 6 to Question 9 to obtain quantitative data (see Appendix 5.2 and sections 5.4.2 and 5.5 for more details). The qualitative individual interview data was used for the purpose of triangulation of the focus groups findings (described in chapter 4/paper 3 of the thesis), referring to the data obtained from the first five questions. This theory testing paper has only used the quantitative data (obtained through Questions 6 to Question 9 of the questionnaire). Designing such an individual interview protocol was planned in the middle of my PhD research journey and was the result of gaining more clarity of thinking as the thesis progressed (see chapter 1).

5.4.1 A Background to the Diary Method

The diary method is a suitable method for the study of human decision making and behaviour processes (Abela, 2009; Laurenceau, Barrett and Rovine, 2005; Laurenceau and Bolger, 2005; Navarro, Arrieta and Ballén, 2007; Radcliffe, 2013). It is a popular method of data collection in medicine, psychology, and organisation studies (Laurenceau and Bolger, 2005), particularly during the last decade. However, the use of the method is still scarce in IS research. Diary studies are categorised into interval-contingent, signal-contingent and event-contingent types (Bolger, Davis and Rafaeli, 2003; Radcliffe, 2013). Research with the first type of diaries is concerned with individuals' ongoing daily experiences, and aim to examine these experiences within a predetermined period of time (e.g. their daily activities or the variation of feelings within a two week period of time). The second type relies on a signaling device provided by the researcher to prompt research participants to provide self-reports at fixed intervals, random intervals or a combination of both. Interval-contingent and signal-contingent diaries are also called time-based diaries. The third type of diary requires research participants to provide a self-report each time a pre-defined event occurs for them during a specific period of time (e.g. the IT problem events or work-family conflicts within two weeks). Based on these descriptions, this theory testing study employs the event-contingent diary type.

The diary method can help to obtain data that is consistent with real research participants' behaviour. It reduces the possibility that the use of a data collection method will alter the participant's own behaviour, for two reasons. First, each participant self-reports information on their own behaviour (e.g. steps of solving a problem) as soon as possible, thereby reducing the possibility of recall problems (Niemi, 1993; Schwarz, 1999; Radcliffe, 2013). Second, the data obtained through the diary method is far less influenced by bias and social desirability (participants' willingness to respond truthfully), which is frequently a limitation of other data collection methods, including direct observation, interview, survey and experimental methods (Niemi, 1993; Robinson, 1985; Robinson, 2002). However, the absence of the researcher in the data collection environment can cause some methodological challenges in ensuring participants' commitment to completing their diaries, the accuracy of responses, and whether sufficient and significant details are gathered. In order to overcome these challenges, literature (e.g. Radcliffe,

2013; Robinson, 2002; Symon, 1998) suggests using a semi-structured diary design, providing clear instructions of how to complete the diary, and maintaining contact with participants (e.g. via emails twice a week). Currently, there is little evidence showing that participation in a diary study can lead to reactance (i.e. a change in an individual's behaviour as a result of participating in a research exercise) and any threat to the validity of data (Bolger et al., 2003; Litt, Cooney and Morse, 1998; Gleason, Bolger and Shrout, 2001).

5.4.2 The Use of Diary Method and Individual Interviews in Tandem

We considered the same types of participants (but different individuals/users), the same types of information technologies, and the same environment of data collection that we had considered in our previous work where we developed TMP and TPP. These include three groups of users including the students, teaching staff and school administrators who use work and study related IT at the same university (Victoria University of Wellington) which is a large New Zealand research university. Users at VUW extensively use various work and study related ITs for which a user support service option is available (thereby, allowing us to collect data about joint- and firm-recovery methods, as well), and many of them frequently experience problems with these ITs. Among these users, three groups represent the majority of IT users at VUW: teaching staff, students and administrators.; They use a wide range of work and study related ITs; they have at least the minimum level of IT literacy; they are diverse (age, background, level of education, gender, level of expertise and ethnicity); and they have access to various resources, such as self-help information, support service and peer support. We also note that there was a convenience aspect for us in our choice of a user organisation. The lead researcher of the study was both studying and working at VUW, and was familiar with the organisation and its IT resources, and had easy access to the three groups of IT users. After a pilot test of the diary with several participants, in order to check clarity, comprehensiveness and the appropriateness of its structure, the diary was emailed to all three groups of participants.

The diary form that we designed starts with instructions[31] and an example[32] showing how the information on solving an IT problem can be written (we note, however, that the instructions explaining how to complete the diary form were mostly presented through the example). No training session on the procedure of completing the diary was conducted for participants, since the pilot test showed that it is easy for them to fully understand the procedure based on the instructions and the example[33]. The rest of the diary includes three sections, each of which is dedicated to one event of an IT problem. Each section asks the participants to describe the problem, explain why they believe that it is a problem, and complete a table outlining the time each decision was made to perform a step, the reason for this decision, what was done and the outcome of that step. The tables were presented in a landscape direction and with unrestricted number of rows to ensure comprehensiveness and easiness of data entry. A sample view of the diary format is presented in appendix 5.1. The instructions (one page) and the example (two pages of the diary form) have not been presented in the appendix.

Participants were asked to complete the diary, in the form of a soft or hard copy, or audio record their decisions and steps via their own cell phone while solving the problem. They were also asked to provide the researcher with their diary during and after completion of their problem solving. We explained to the participants that our questions during the interview will be based on the information on their decisions and steps they report in their diary. We also explained that the information on solving one IT problem is the minimum required information, the form should be completed during the two weeks after receiving it, and that this time may be extended if no IT problem occurs during this period of time or if the participant is willing to provide information on more possible IT problem events. All participants preferred to send a soft copy of their completed diary (not the printed version or an audio file of their voice). We also note that a reminder was sent once a week to each participant, via email, to ensure participants' compliance with completing their diary forms.

[31] We consider an IT problem (a problem with work and study related IT in this study) as a user's *perception* of such a problem. For example, there may not be a real technical problem with an IT, but a user has a misunderstanding that such as problem has occurred. There are many possible reasons why this may happen, for example his/her lack of knowledge or skills. Therefore, the instructions part of the diary form did not provide any specific definition for IT problems for which participants should fill the form. Instead, we found a few common examples of these problems (in the instructions part) a suitable practice.

[32] In the instructions part, we also specifically stated that "this is just an example of several ways of solving an IT problem. This research aims to…, it does not aim to study right or wrong ways of IT problem solving or to evaluate your skills or knowledge".

[33] Of course, in the invitation email, information sheet and the instructions, we mentioned our willingness to provide a fast and complete response to any participant question about filling out their diary forms.

33 users participated in the study and sent us their diary forms. We identified 60 IT problem events through reviewing the answers of the first question. 9 of these were excluded, as they were not IT problems (e.g., they were a task problem, a user's question about how to work with a software for the first time, and a service problem like not informing a user about upgrading their software prior to the upgrade). Overall, 51 IT problem events were identified and were considered for more precise analysis through the individual interviews. These events were reported by 30 participants, who attended the individual interview sessions as well.

During the interviews, each participant was asked to complete a questionnaire through which quantitative data was obtained to test the TMP and TPP. The interview questionnaire (see appendix 5.2) included a few open ended questions as well (questions 7.2, 7.3, 8.1 and 9) to obtain more detailed information. Appendix 5.2 presents the interview protocol as well as the questionnaire. All interviews were conducted at the University for participant convenience. The interviews were audio recorded, and the time of the interviews varied from 25 minutes to 50 minutes, dependent on the number of IT problems each participant had reported in their diary.

In order to help each participant to get back to the points of time they made a decision to persist or not, each participant was provided with a simple sequence diagram of the methods they had reported in their diary. Figure 5.3 illustrates an example of these diagrams. Using the diagram we showed the start time point, the period of time between the start and the end, and the end time point for each method, and the period of time between the end of the method and the start of the next method. Next, we asked the interview questions that were designed specifically for each of these time points and periods of time. Although a range of time points and related questions can be imagined, the pilot test showed that considering a greater number of time points creates difficulty for the participants when remembering their problem solving decisions - a factor that can lead to unreliable responses. We also note that in order to deal with a situation in which a participant had used more than one method, we used multiple copies of the questionnaire and asked the participant to complete each copy for each method they used. The completed copies were then numbered immediately based on the sequence of the methods reported in the diary form.

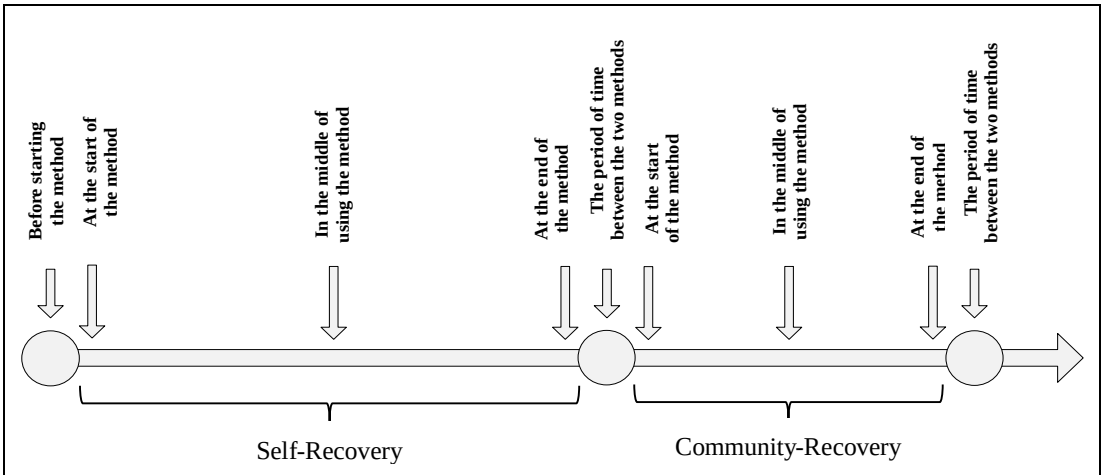

Figure 5.3: An Example of Sequence Diagram Used in the Individual Interviews

5.5 FINDINGS

Table 5.1 presents some brief information on the most frequent types of IT problems (among the 51 IT problem events) that occurred for the 30 participants during the data collection.

Table 5.1: The Most Frequent Types of IT Problems for the Users

Type of Participant	Number of Participants	Frequent Type of IT Problem
Teaching Staff	8	Problems with work related media, especially problems with email after a change in the email server.
Student	17	Problems with network connectivity (mostly, problems with wireless networks) when trying to use mobile devices.
School Administrator	5	Problems with storing and retrieving information: problems with servers, computer drives and the workforce management system when trying to store and/or retrieve information.

The answers for the second question of the diary form show that users perceive an IT problem as an obstacle or an unpredictable situation for which there is no apparent or immediately available solution, and that frequently there is a need for some efforts of problem solving (e.g., searching for information) to be able to describe it accurately. This was later supported by the individual interviews, where the participants mentioned the same opinions. They explained that the unpredictable nature, being difficult to describe, and the lack of an obvious way of solving the IT problems they experienced, are the reasons why they often had to use more than one method of solving IT problems.

The diary data shows that only 3 out of the 51 problems were unsolved, two of which the user did not continue solving the problem through a second method. Overall, over 80% of the problem solving efforts started with some self-recovery efforts. Community-recovery is the most frequent second method and usually started rapidly after the self-recovery method and was mostly employed by the student IT users. Lastly, joint-recovery is the most frequent third method. As explained, the decisions and steps taken to solve an IT problem by each participant were reviewed, summarised, and illustrated through a simple sequence diagram that shows what methods the user used to solve their own problem. The diagram was presented to each participant during the interview to help them remember and get back to the points of time they made decisions to persist or give up with solving the problem.

Tables 5.2 to 5.9 present the quantitative data we obtained through the individual interviews. The results related to the method persistence are presented in Tables 5.2 to 5.6, and the results related to the process persistence are presented in Tables 5.7 to 5.9.

Table 5.2 presents the data related to the start of the first method each participant used to solve their own IT problem. Also, the last column of the table shows the participants' responses for the question (question 7.2) related to the period of time between the start and the end of the method[34]. Table 5.3 presents the data related to the end of the first method. The table does not present any data related to the end of the method for the users *who achieved a satisfactory outcome*. Any data for this part is meaningful only if it has been obtained from a user who did not achieve a satisfactory outcome through this method and gave up the method or may have continued to solve the problem through a second method.

[34] As explained in the legend of the table, EMC at a point in time has been measured as the average of all four cost factors at that point of time. For example, EMC at the start of using a method has been measured as (EE+ET+ENF+EM)/4 at that point of time.

Table 5.2: Decision to Persist in Solving the Problem while Using Method 1:
The data related to the start of the first method each participant used; and the data related to the period of time between the start and the end of the method. P: Participant # ; I: Incident # ; P(SOM): Probability of a Satisfactory Outcome through a method; ISO: Importance of a Satisfactory Outcome; EE: Expected Effort; ET: Expected Time; ENF: Expected Negative Feelings (e.g. anxiety); EM: Expected Money; EMC: Expected Method Cost; EMC at a point of time = (EE+ET+ENF+EM)/4 at that point of time

At the Start of Method 1										Between the start and the end of method 1
P,I	P(SOM)	ISO	EE	ET	ENF	EM	EMC	P(SOM)*ISO	P(SOM)*ISO>EMC	P(SOM)*ISO>EMC
1,1	70%	4	4	3	3	1	2.75	2.8	Yes	Yes
2,1	75%	3	2	1	3	0	1.5	2.25	Yes	Yes
2,2	95%	4	1	1	1	1	1	3.8	Yes	Yes
3,1	96%	3	1	1	1	1	1	2.88	Yes	Yes
4,1	65%	4	1	2	3	1	1.75	2.6	Yes	Yes
5,1	60%	4	3	4	1	0	2	2.4	Yes	Yes
6,1	80%	3	2	2	2	2	2	2.4	Yes	Yes
6,2	90%	2	1	1	1	1	1	1.8	Yes	Yes
6,3	70%	2	1	1	1	1	1	1.4	Yes	Yes
7,1	100%	4	1	2	2	0	1.25	4	Yes	Yes
8,1	20%	4	1	1	1	0	0.75	0.8	Yes	Yes
8,2	100%	4	2	2	2	0	1.5	4	Yes	Yes
9,1	90%	3	1	1	1	0	0.75	2.7	Yes	Yes
10,1	100%	4	1	1	0	0	0.5	4	Yes	Yes
10,2	100%	3	1	1	0	0	0.5	3	Yes	Yes
11,1	80%	4	3	3	3	0	2.25	3.2	Yes	Yes
12,1	95%	4	3	4	4	1	3	3.8	Yes	Yes
13,1	80%	1	1	1	1	0	0.75	0.8	Yes	Yes
13,2	90%	3	1	1	1	0	0.75	2.7	Yes	Yes
14,1	50%	4	3	1	3	0	1.75	2	Yes	Yes
15,1	100%	4	2	1	2	0	1.25	4	Yes	Yes
15,2	80%	4	2	2	3	0	1.75	3.2	Yes	Yes
16,1	75%	4	2	3	4	1	2.5	3	Yes	Yes
17,1	90%	3	3	3	3	1	2.5	2.7	Yes	Yes
17,2	90%	4	2	2	2	0	1.5	3.6	Yes	Yes
18,1	30%	4	2	1	1	0	1	1.2	Yes	Yes
19,1	50%	3	1	1	0	0	0.5	1.5	Yes	Yes
20,1	100%	4	1	1	1	1	1	4	Yes	Yes
20,2	100%	4	1	1	1	0	0.75	4	Yes	Yes
20,3	100%	4	1	1	0	0	0.5	4	Yes	Yes
20,4	100%	4	1	1	1	0	0.75	4	Yes	Yes
20,5	100%	4	1	1	0	0	0.5	4	Yes	Yes
21,1	100%	4	1	0	0	0	0.25	4	Yes	Yes
21,2	98%	4	1	0	1	0	0.5	3.92	Yes	Yes
21,3	99%	4	1	0	1	1	0.75	3.96	Yes	Yes
22,1	95%	4	0	0	1	0	0.25	3.8	Yes	Yes
22,2	70%	4	2	2	3	2	2.25	2.8	Yes	Yes
23,1	80%	3	1	1	1	0	0.75	2.4	Yes	Yes
23,2	100%	4	2	3	2	0	1.75	4	Yes	Yes
23,3	80%	3	1	1	1	0	0.75	2.4	Yes	Yes
23,4	100%	4	1	1	1	0	0.75	4	Yes	Yes
23,5	100%	4	1	1	1	0	0.75	4	Yes	Yes
24,1	70%	2	2	1	1	0	1	1.4	Yes	Yes
25,1	100%	4	3	3	3	3	3	4	Yes	Yes

25,2	70%	2	2	1	2	0	1.25	1.4	Yes	Yes
25,3	90%	2	1	1	1	0	0.75	1.8	Yes	Yes
26,1	90%	3	3	2	3	0	2	2.7	Yes	Yes
27,1	100%	4	1	1	0	0	0.5	4	Yes	Yes
28,1	50%	3	1	1	2	0	1	1.5	Yes	Yes
29,1	90%	4	4	1	0	0	1.25	3.6	Yes	Yes
30,1	60%	3	2	2	2	0	1.5	1.8	Yes	Yes

Table 5.3: Decision to Give Up Method 1:
The data related to the end of the first method employed by users who (1) did not achieve a satisfactory outcome through the method and gave up their problem solving, or (2) decided to continue solving their problem through a second method.

At the end of the first method									
P,I	P(SOM)	ISO	EE	ET	ENF	EM	EMC	P(SOM)*ISO	P(SOM)*ISO>EMC
1,1	20%	4	4	3	4	1	3	0.8	No
4,1	20%	4	4	3	4	2	3.25	0.8	No
5,1	5%	4	4	4	3	0	2.75	0.2	No
6,3	40%	2	1	1	1	1	1	0.8	No
7,1	0%	4	4	4	4	0	3	0	No
8,1	0%	4	4	4	4	0	3	0	No
9,1	5%	3	2	2	2	2	2	0.15	No
10,1	0%	4	3	3	3	3	3	0	No
11,1	0%	4	1	2	2	0	1.25	0	No
12,1	10%	4	3	4	4	3	3.5	0.4	No
14,1	20%	4	4	3	4	0	2.75	0.8	No
15,1	0%	4	4	4	4	0	3	0	No
15,2	60%	4	4	3	4	0	2.75	2.4	No
16,1	10%	4	4	4	4	3	3.75	0.4	No
17,1	50%	3	2	2	2	2	2	1.5	No
19,1	1%	3	3	3	1	0	1.75	0.03	No
20,1	30%	4	4	3	3	3	3.25	1.2	No
20,4	10%	4	4	4	3	3	3.5	0.4	No
21,1	10%	4	3	3	4	3	3.25	0.4	No
21,2	10%	4	4	3	3	4	3.5	0.4	No
21,3	9%	4	4	4	3	3	3.5	0.36	No
22,1	10%	4	4	4	3	0	2.75	0.4	No
22,2	0%	4	4	4	3	0	2.75	0	No
23,2	75%	4	4	4	4	0	3	3	No
23,3	0%	3	4	4	1	0	2.25	0	No
23,4	50%	3	3	3	0	2	2	1.5	No
24,1	0%	2	4	4	4	0	3	0	No
25,1	50%	4	4	4	4	0	3	2	No
25,2	20%	2	4	4	4	0	3	0.4	No
27,1	0%	4	4	4	4	0	3	0	No
29,1	10%	4	4	4	4	0	3	0.4	No
30,1	10%	3	3	3	2	0	2	0.3	No

Table 5.4 presents the data related to the start of the second method. Like Table 5.2, the last column of the table presents the participants' responses for the period of time between the start and the end

of the method. Table 5.5 presents the data related to the end of the second method. Like Table 5.3, the table does not present any data related to the end of the method for the users *who have achieved a satisfactory outcome* through this method.

Table 5.4: Decision to Persist in Solving the Problem while Using Method 2:
The data related to the start of the second method each participant used; and the data related to the period of time between the start and the end of the method.

At the Start of Method 2										Between the start and the end of method 2
P,I	P(SOM)	ISO	EE	ET	ENF	EM	EMC	P(SOM)*ISO	P(SOM)*ISO>EMC	P(SOM)*ISO>EMC
1,1	90%	4	1	1	2	4	2	3.6	Yes	Yes
4,1	60%	4	2	2	2	2	2	2.4	Yes	Yes
5,1	90%	4	1	0	0	0	0.25	3.6	Yes	Yes
7	90%	4	3	3	3	0	2.25	3.6	Yes	Yes
8,1	95%	4	1	1	2	0	1	3.8	Yes	Yes
9,1	95%	3	2	1	2	2	1.75	2.85	Yes	Yes
10,1	100%	4	1	1	0	0	0.5	4	Yes	Yes
11,1	80%	4	1	1	1	1	1	3.2	Yes	Yes
12	90%	4	4	4	3	3	3.5	3.6	Yes	Yes
14	50%	4	1	1	1	0	0.75	2	Yes	Yes
15,1	100%	4	2	2	3	0	1.75	4	Yes	Yes
15,2	100%	4	2	2	3	0	1.75	4	Yes	Yes
16	85%	4	3	3	3	3	3	3.4	Yes	Yes
19,1	100%	3	1	1	1	0	0.75	3	Yes	Yes
20,1	95%	4	1	1	1	0	0.75	3.8	Yes	Yes
20,4	98%	4	1	0	0	1	0.5	3.92	Yes	Yes
21,1	95%	4	1	1	1	0	0.75	3.8	Yes	Yes
21,2	97%	4	1	0	0	1	0.5	3.88	Yes	Yes
21,3	95%	4	1	1	1	0	0.75	3.8	Yes	Yes
22,1	100%	4	0	1	2	0	0.75	4	Yes	Yes
22,2	50%	4	1	2	3	0	1.5	2	Yes	Yes
23,2	100%	4	1	1	1	0	0.75	4	Yes	Yes
23,3	100%	3	1	1	1	0	0.75	3	Yes	Yes
23,4	100%	4	1	1	1	0	0.75	4	Yes	Yes
24,1	90%	2	1	1	1	0	0.75	1.8	Yes	Yes
25,1	50%	4	1	1	1	1	1	2	Yes	Yes
25,2	50%	2	1	1	1	0	0.75	1	Yes	Yes
27,1	100%	4	1	1	1	0	0.75	4	Yes	Yes
29,1	90%	4	3	1	0	0	1	3.6	Yes	Yes
30,1	70%	3	2	2	2	0	1.5	2.1	Yes	Yes

Table 5.5: Decision to Give Up Method 2:
The data related to the end of the second method employed by users who (1) did not achieve a satisfactory outcome through the method and gave up their problem solving, or (2) decided to continue solving their problem through a third method

At the End of Method 2									
P,I	P(SOM)	ISO	EE	ET	ENF	EM	EMC	P(SOM)*ISO	P(SOM)*ISO>EMC
20,1	20.00%	4	4	3	3	3	3.25	0.8	No
20,4	15.00%	4	4	4	3	4	3.75	0.6	No
21,1	15.00%	4	3	3	3	4	3.25	0.6	No
21,2	9.00%	4	3	4	4	4	3.75	0.36	No
21,3	14.00%	4	4	4	4	3	3.75	0.56	No
22,2	0.00%	4	4	4	4	4	4	0	No
29,1	10.00%	4	4	4	3	0	2.75	0.4	No
30,1	10.00%	3	3	4	3	0	2.5	0.3	No

Table 5.6 presents the data related to the start of the third method which was used by six participants who had not achieved a satisfactory outcome through the second method and continued to solve their problems through a third method. The last column of the table presents the participants' responses for the period of time between the start and the end of the method. In this study, each of the participants *who used a third method* achieved a satisfactory outcome and stopped the problem solving process.

Table 5.6: Decision to Persist in Solving the Problem while Using Method 3:
The data related to the start of the third method each participant used; and the data related to the period of time between the start and the end of the method.

At the Start of Method 3										Between the start and the end of method 3
P,I	P(SOM)	ISO	EE	ET	ENF	EM	EMC	P(SOM)*ISO	P(SOM)*ISO>EMC	P(SOM)*ISO>EMC
20,1	100%	4	1	0	0	1	0.5	4	Yes	Yes
20,4	100%	4	1	0	0	0	0.25	4	Yes	Yes
21,1	96%	4	1	0	1	1	0.75	3.84	Yes	Yes
21,2	90%	4	1	2	2	2	1.75	3.6	Yes	Yes
21,3	96%	4	1	1	1	1	1	3.84	Yes	Yes
29,1	100%	4	4	2	1	0	1.75	4	Yes	Yes
30,1	75%	3	2	2	3	0	1.75	2.25	Yes	Yes

Tables 5.7 to 5.9 present the data related to the process persistence (responses to questions 8.1 and 8.2). Among these, the results presented in Table 5.9 is based on Tables 5.7 and 5.8. It presents the results of calculating the P(SOP) by calculating average of P(SO M1-M2) and P(SO M2-M3)[35] (if three methods have been used), and the results of calculating EPC by calculating average of EC

[35] P(SO M*i*-M*j*): probability of a satisfactory outcome after giving up method *i* and before starting method *j*

M1-M2 and EC M2-M3[36] (see questions 8.1 and 8.2 of the questionnaire in appendix 5.2), and shows that in order to solve the IT problems for which more than one method was used the user persisted with the entire process of solving the problem if P(SOP)*ISO is greater than EPC.

Table 5.7: Decision to Persist in Solving the Problem (after Giving Up Method 1):
The data related to the period of time between giving up method 2 and deciding to start method 3 ; P(SO M1-M2): probability of satisfactory outcome after giving up method 1 and before starting method 2 ; EC M1-M2: expected cost after giving up method 1 and before starting method 2

P,I	P(SO M1-M2)	ISO	EC M1-M2	P(SO M1-M2)*ISO	P(SO M1-M2)*ISO > EC M1-M2	Proceeded to another method?
1,1	90%	4	2	3.6	Yes	Yes
5,1	90%	4	2	3.6	Yes	Yes
7,1	100%	4	3	4	Yes	Yes
8,1	90%	4	1	3.6	Yes	Yes
9,1	99%	3	2	2.97	Yes	Yes
10,1	100%	4	0	4	Yes	Yes
11,1	80%	4	1	3.2	Yes	Yes
12,1	90%	4	3	3.6	Yes	Yes
14,1	90%	4	1	3.6	Yes	Yes
15,1	100%	4	0	4	Yes	Yes
15,2	100%	4	0	4	Yes	Yes
16,1	95%	4	3	3.8	Yes	Yes
19,1	100%	3	0	3	Yes	Yes
20,1	95%	4	0	3.8	Yes	Yes
20,4	95%	4	1	3.8	Yes	Yes
21,1	95%	4	1	3.8	Yes	Yes
21,2	95%	4	1	3.8	Yes	Yes
21,3	90%	4	1	3.6	Yes	Yes
22,1	100%	4	1	4	Yes	Yes
22,2	90%	4	3	3.6	Yes	Yes
23,2	100%	4	1	4	Yes	Yes
23,3	100%	3	2	3	Yes	Yes
23,4	100%	4	1	4	Yes	Yes
24,1	90%	2	1	1.8	Yes	Yes
25,1	50%	4	1	2	Yes	Yes
25,2	60%	2	1	1.2	Yes	Yes
27,1	100%	4	1	4	Yes	Yes
29,1	90%	4	1	3.6	Yes	Yes
30,1	70%	3	2	2.4	Yes	Yes

[36] EC M*i*-M*j*: expected cost after giving up method *i* and before starting method *j*

Table 5.8: Decision to Persist in Solving the Problem (after Giving Up Method 2):
The data related to the period of time between giving up method 2 and deciding to start method 3; P(SO M2-M3): probability of a satisfactory outcome after giving up method 2 and before starting method 3; EC M2-M3: expected cost after giving up method 2 and before starting method 3

P,I	P(SO M2-M3)	ISO	EC M2-M3	P(SO M2-M3)*ISO	P(SO M2-M3)*ISO > EC M2-M3	Proceeded to another method?
20,1	95%	4	1	3.8	Yes	Yes
20,4	95%	4	1	3.8	Yes	Yes
21,1	95%	4	1	3.8	Yes	Yes
21,2	90%	4	1	3.6	Yes	Yes
21,3	93%	4	1	3.72	Yes	Yes
29,1	100%	4	1	4	Yes	Yes
30,1	75%	3	2	2.4	Yes	Yes

Table 5.9: User's Decision to Persist in the Overall Process of Solving the IT Problem:
Calculating probability of achieving a satisfactory outcome across the whole process P(SOP) and expected process cost (EPC). P(SOP) = average of P(SO M1-M2) and P(SO M2-M3) ; EPC = average of EC M1-M2 and EC M2-M3. A user persists with the entire process of solving an IT problem if P(SOP)*ISO > EPC

P,I	P(SO M1-M2)	P(SO M2-M3)	P(SOP)	ISO	EC M1-M2	EC M2-M3	EPC	P(SOP)*ISO	P(SOP)*ISO > EPC
1,1	90%		90%	4	2		2	3.6	Yes
5,1	90%		90%	4	2		2	3.6	Yes
7,1	100%		100%	4	3		3	4	Yes
8,1	90%		90%	4	1		1	3.6	Yes
9,1	99%		99%	3	2		2	2.97	Yes
10,1	100%		100%	4	0		0	4	Yes
11,1	80%		80%	4	1		1	3.2	Yes
12,1	90%		90%	4	3		3	3.6	Yes
14,1	90%		90%	4	1		1	3.6	Yes
15,1	100%		100%	4	0		0	4	Yes
15,2	100%		100%	4	0		0	4	Yes
16,1	95%		95%	4	3		3	3.8	Yes
19,1	100%		100%	3	0		0	3	Yes
20,1	95%	95%	95%	4	0	1	0.5	3.8	Yes
20,4	95%	95%	95%	4	1	1	1	3.8	Yes
21,1	95%	95%	95%	4	1	1	1	3.8	Yes
21,2	95%	90%	92%	4	1	1	1	3.7	Yes
21,3	90%	93%	91%	4	1	1	1	3.66	Yes
22,1	100%		100%	4	1		1	4	Yes
22,2	90%		90%	4	3		3	3.6	Yes
23,2	100%		100%	4	1		1	4	Yes
23,3	100%		100%	3	2		2	3	Yes
23,4	100%		100%	4	1		1	4	Yes
24,1	90%		90%	2	1		1	1.8	Yes
25,1	50%		50%	4	1		1	2	Yes
25,2	60%		60%	2	1		1	1.2	Yes
27,1	100%		100%	4	1		1	4	Yes
29,1	90%	100%	95%	4	1	1	1	3.8	Yes
30,1	70%	75%	72%	3	2	2	2	2.16	Yes

In summary, the analysis of the individual interviews (Tables 5.2 to 5.9) show that the data related to user persistence with solving each of the 51 IT problem events confirm both the TMP and TPP. In other words, for each of the IT problem events and for each of the methods, the user persisted in solving the problem through the method if P(SOM)*ISO is greater than EMC. In regard to solving the IT problems for which the user used more than one method, the user persisted with the entire process of solving the problem if P(SOP)*ISO is greater than EPC.

Moreover, all participants' responses to the related open ended questions (questions 7.2., 7.3 and 8.1) are consistent with the results of the quantitative data analysis. For example, in response to the question about method persistence (question 7.3) two participants mentioned:

> *I did not continue my own efforts. Initially, I though it will be quick, but later I realised that it takes long and need a high level of effort. Also, the probability (of achieving a satisfactory) outcome was getting too low. If not zero, between five to ten percent.*

> *I knew that it can be solved… and solving this problem was important enough that I would go on regardless of other things.*

Also, in response to the question about process persistence (question 8.1) the participants mentioned comments like:

> *I was becoming less sure that I will get that [satisfactory] outcome as I went through, but it (my persistence) was because it was apparent how much I needed to get my assignment done, although my effort may become higher.*

> *[In the middle of solving this problem] I was thinking that I can solve this problem easily and it won't take too long. I was thinking that maybe 80% this problem can be solved and it won't take much effort and time and even anxiety to solve it.*

We also considered the analysis of these open ended questions as an opportunity for identifying any emerging insight or idea about method persistence and process persistence. However,

compared with the findings of our previous work, none of the participants' comments led to identification of any new insight or idea.

5.6 DISCUSSION

In our previous work, we developed the Theory of Method Persistence (TMP) which explains why a user decides to persist with a specific method of solving IT problems, and developed the Theory of Process Persistence (TPP) which explains why the user decides to persist with the overall process of solving the problem. In this study, we used the diary method and individual interviews to test these two theories. We started data collection through the Diary method. The diary method has been widely used in psychology studies of an individual's decision making and behaviour, but rarely in IS research. Our use of the method helped us gather data from users in real life settings, minimising any influence from the researcher on the user' persistence in solving their own IT problem. The data we gathered through each user's diary provided the platform for the interview with that user. The analysis of the interview data confirmed our two theories of TMP and TPP. Below we present the contributions of this study to theory and practice, a statement of study limitations and our suggestions for how future IS research can further test the robustness of the two theories.

5.6.1 Contributions

We believe that our findings have implications for motivation-based, problem-solving theories; theoretical models of user coping and adaptation; and user learning and enhanced use of IT[37]. First, we believe that the mental evaluation process of TMP and TPP we tested and confirmed in this paper may be adaptable for motivation-based problem-solving studies which aim to explain and/or predict why people decide to persist in solving any real-life problem. This may be particularly useful for studying problems for which more than one method of problem solving exist.

Second, the findings can extend the theoretical models of user coping and adaptation. To our knowledge, no research in this area has specifically focused on studying IT problems as an IT

[37] As already explained, this paper has mainly focused on testing TMP and TPP. See the previous chapter (the theory building paper) for details on each of these concepts and for more details on the theoretical implications of the findings.

event/interruption. Our findings can extend the theoretical models and theories of user coping and adaptation by suggesting that IT problems can also be considered as an IT event/interruption. Also, see the previous chapter for our suggestion on how the P(SOM) construct and the factors contributing to the construct can contribute to a more comprehensive conceptualisation of user's evaluation at the secondary appraisal stage of the Coping Theory.

Third, user persistence in solving their own IT problem may also contribute to user learning and enhanced use of IT[38], as user persistence can lead to identifying some previously unknown or unused useful IT features and/or a more efficient way of interacting with the IT. We therefore suggest that studies in this area can explore the process of user learning and enhanced use more comprehensively by considering IT problems as a type of IT interruption, and by identifying which of the four methods of IT problem solving that we identified (i.e. self-, community-, joint- and firm-recovery) can contribute more to this process.

In addition to operationalising and measuring all the cost factors in both TMP and TPP, the findings show that emotions (as a cost factor) contribute to a user's *'decision'* to persist in solving their IT problem; thus, emotions are consciously accessible (by the individual) and calculable (see the previous chapter for a more detailed discussion of this). This is in fact a rival explanation to the view (e.g. Carver and Scheier, 1981; Mohr, 1996; Spielman, Pratto and Bargh, 1988) that emotions drive post-adoptive behaviours directly and individuals are not consciously aware of the effect of their emotions on their behaviours.

According to the diary data, most student IT users start to solve their own IT problems through the self-recovery method, but persist less with this method and switch quickly to the community-recovery method. Similarly, teaching staff start solving their own IT problems with self-recovery efforts, but have a greater tendency toward joint-recovery as their second method. The administrator IT users started with self-recovery efforts, and firm-recovery is their most frequent second method. These general patterns among the participants of the study clearly show the importance of self-recovery method (which also shows the importance of the factors, such as

[38] As explained in chapter 4 (paper 3), 'enhanced use' of IT represents novel ways of employing IT features and can have three major forms including using a formerly unused set of IT features, using one or more current features of an IT for additional tasks, and 'features extensions' which is defined as extending the features of an IT to perform a current or other task.

quality of self-help information that contribute to user persistence with this method) and the usefulness of employing interactive media (e.g., social media and online discussion forums) that facilitates the community-recovery efforts.

5.6.2 Limitations

We emphasised to the participants the importance of including all IT problem events they experienced and details on how they solved them in their diary. However, there might have been the possibility that some participants did not completely comply with completing their diary because of the effort involved. In addition, some participants might have not included one or more IT problem events in their diaries because they did not perceive them as IT problems. This is, in fact, a limitation of the diary method and similar methods of data collection which rely on participants' self-report on past events and how they were handled. We, however, believe that neither of these two possibilities represents a significant risk to the reliability of the findings, since collecting all possible data about all IT problem events is not of a significant theoretical sensitivity for this study.

Once an event occurred, individuals might update their beliefs about their perceived probability of that event accordingly (i.e. the risk of insight bias). As mentioned, we employed the diary method and asked participants to report IT problems they experienced, and how they solved them, as soon as possible in their diaries. Although we believe that this is the best possible approach that we could have used to collect data on user persistence in solving real-life IT problems, and at the same time minimising the risk of insight bias, we cannot claim that we could perfectly overcome this risk. One way to further ensure the reliability of findings could have been employing an additional method of data collection, such as laboratory and experimental methods, but this must be left to future IS research.

Moreover, the delay between the IT problem events and interviews could have led participants to forget key emotions they were experiencing while solving their IT problems (i.e. the risk of recall bias). We tried to minimise this risk by reviewing the reported information in participants' dairies for them during the interviews and helping them to get back to their process of IT problem solving

(see section 5.4.2 and Figure 5.3). However, as suggested above, employing an additional method of data collection (e.g. laboratory/experimental methods) can provide even more confidence in the findings. Also, this could have been done by asking participants to contact the researcher once an IT problem occurs for them and that the researcher employs an observation method while the participant is solving the problem.

5.6.3 Suggestions for Future Research

We invited the same types of participants (students, teaching staff and administrator IT users) who use the same types of IT (work and study related IT) at the same university that we considered in our theory development study. These participants are well-educated and have a medium to high level of perseverance. Also, they have access to user support services and are able to interact with many other users of a particular IT. We suggest future research to further test TMP and TPP by considering different types of ITs and different types of participants at different environments.

We note that the data we collected through the diaries could provide us with additional information, if for example, we were aiming to identify detailed patterns of IT problem solving among different users. We suggest future IS studies to consider the use of the method to identify these detailed patterns. Future researchers may also wish to use the method to develop a process theory of IT problem solving that explains the steps of IT problem-solving and the sequence of these steps from the user's perspective.

The interviews showed that the importance of achieving a satisfactory outcome (ISO) remained constant during the entire process of solving each IT problem. In addition, we found that solving an IT problem can be important for each user for a variety of reasons, such as avoiding a negative influence on one's own or others' work or study. We suggest future information systems research investigate the factors that contribute to a user's perceived importance when solving an IT problem.

In this study we did not aim to measure user persistence or study user success in solving an IT problem. However, for the studies in this area, we suggest considering the time spent for the overall process, number of methods used and number of decision points (to continue or quit) within the

entire process for a more accurate measurement of user persistence and the investigation of the relationship between persistence and success in solving the problem.

Our methods of data collection provided the opportunity of gathering data about user persistence in solving IT problems that occur in real life situations, and to minimise the researcher's influence on the participants' behaviour of persistence. However, we suggest future IS research to further test the TMP and TPP through different methods, such as experiment and think-aloud methods where participants are given the task of solving a particular IT problem.

5.7 CONCLUSION

In this study, we used the diary and individual interviews methods in tandem to test the Theory of Method Persistence (TMP) and the Theory of Process Persistence (TPP) which had been developed in our previous work. The results of our data analysis confirmed the two theories. The paper also explained that how each of the two theories makes an original contribution to IS research (i.e. to theoretical models of user coping, adaptation, user learning and enhanced use of IT) and to the motivation-based studies of persistence and problem solving in psychology research. This was then followed by a statement of study limitations and our suggestions for how future IS research can further test the robustness of TMP and TPP.

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APPENDIX 5.1: The User Diary Format

Introducing the Study and Its Purpose
The instructions accompanied by an example on how to complete the diary

Problem # __

Please describe the problem briefly.

Why do you believe this is a problem?

Please provide as specific information about your decisions and actions as possible while you are solving the problem. Please note that each step in this form must be completed as soon as you make a decision and finish an action.

Step	Start date & time	Finish date & time	What Intended (what did you decide to do)? and Why?	Did you perform this decision? If no, why? If yes, what was done (what did you do in this step)?	Outcome?
1					
2					
3					
. . .					
n					

What was the overall outcome (e.g., solved, unsolved,...)? ……

In your opinion, what were the most important factors that contributed to this outcome and your persistence?

APPENDIX 5.2: The Interview Questions

1) You mentioned that you had a problem with …... and you started solving it. Could you please explain what the problem was, again?

2) Why do you believe that it is a problem?

3) Why did you make the decisions and take the steps (that you have reported in the diary)? Why did you persist in solving the problem?

4) What things helped you or had a negative effect on your persistence in solving the problem through this method (method x)? [Probe questions have not been presented]

5) What things helped you or had a negative effect on your persistence in solving the problem during the entire process of solving the problem? [Probe questions have not been presented]

6) To what degree a satisfactory outcome is important for you?

0☐ 1☐ 2☐ 3☐ 4☐

0: It does not matter whether I achieve a satisfactory outcome

4: It is essential that I achieve a satisfactory outcome

7) Questions about method persistence (the questions are repeated for each method used):

7.1. When you started this method:

How likely did you think it would be you would reach a satisfactory outcome? .....%

%0: A satisfactory outcome will never be achieved.

%100: A satisfactory outcome will be achieved definitely.

How much effort did you think you would need to achieve a satisfactory outcome?

nothing **too high**

0☐ 1☐ 2☐ 3☐ 4☐

How much time did you think you would need to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

You were expecting/thinking that how much anxiety or frustration you have to endure to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

You were expecting/thinking that how much money you have to spend to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

7.2. You continued solving the problem through this method for some time, because you were expecting that you may achieve a satisfactory outcome that is worth more than the effort and time required? Yes☐ No☐ Could you explain why [Probe questions have not been presented]

7.3. Why did you stop using this method and switch to another method?

7.4. Right before stopping using this method:

If you were to persist with this method, how likely did you think it would be you would reach a satisfactory outcome? ……..%

%0: A satisfactory outcome will never be achieved.

%100: A satisfactory outcome will be achieved definitely.

If you were to persist with this method, how much effort did you think you would need to achieve a satisfactory outcome?

nothing **too high**

0☐ 1☐ 2☐ 3☐ 4☐

If you were to persist with this method, how much time did you think you would need to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

If you were to persist with this method, you were expecting that what level of anxiety or frustration you have to endure to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

If you were to persist with this method, you were expecting that what amount of money you have to spend to achieve a satisfactory outcome?

0☐ 1☐ 2☐ 3☐ 4☐

8) Questions about process persistence:

8.1. At this point, why did you continue and did not give up?

8.2.You decided to continue solving the problem. At this point:

How would you rate the overall importance of a satisfactory outcome?

nothing **essential**

0☐ 1☐ 2☐ 3☐ 4☐

How would you rate the overall probability of achieving a satisfactory outcome? .....%

%0: A satisfactory outcome will never be achieved.

%100: A satisfactory outcome will be achieved definitely.

How would you rate the overall cost (e.g., time and effort) of solving this problem?

nothing **too high**

0☐ 1☐ 2☐ 3☐ 4☐

9) Do you have any other comment about your persistence with this method?

Chapter 6

6. CONTRIBUTIONS AND CONCLUSION

The body of the thesis includes four original articles each of which constituted a chapter. Figure 6.1 (also presented in chapter 1) presents the conceptual framework. It illustrates how the four articles constituted the body of this thesis, and that which research questions are answered by which article. Each article presented a detailed description of its own research methods, findings, contributions, limitations and suggestions for future research. In order to avoid repetition, this chapter presents a summary of the contributions of the overall thesis to theory (where applicable, this includes some new ideas for further research, as well), to methodology and to practice.

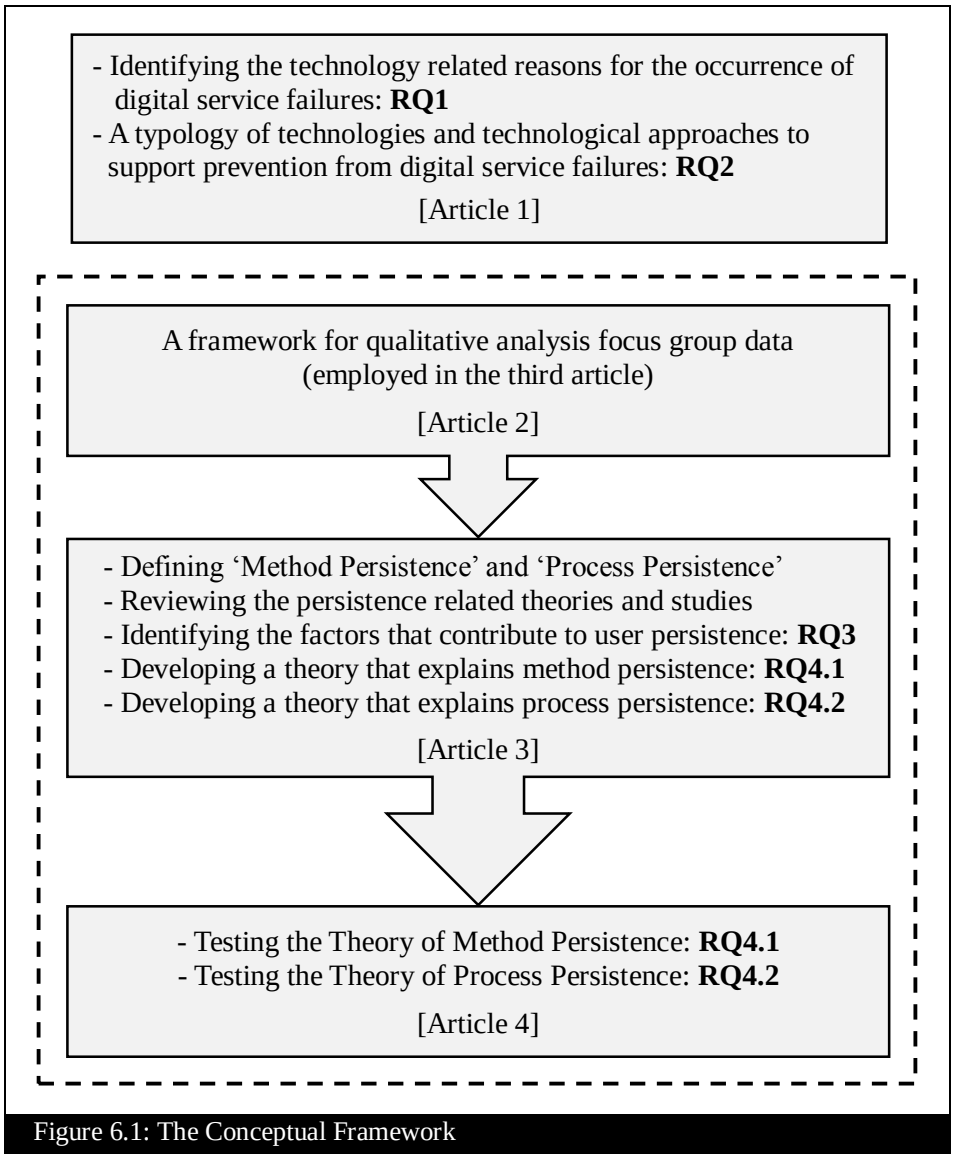

Figure 6.1: The Conceptual Framework

6.1 CONTRIBUTION TO METHODOLOGY

It was argued that many IS studies would benefit from a rich analysis of different types of focus group data to investigate and answer their research questions. The benefits of the focus group method for the IS research clearly show the need to have a clear and rigorous focus group data analysis procedure for IS researchers. Therefore, the second article suggested a systematic and integrative approach for qualitative analysis of different types of focus group data. The article also presented some recommendations on how to enhance trustworthiness in the qualitative analysis of focus groups. It is important to note that as a user is the focus of the user persistence study and because a perceived event of problem is the unit of analysis, the analysis of interaction data is less relevant to the topic of this research and is of less theoretical sensitivity for this thesis. However, for the purpose of completeness, the analysis framework considered the analysis of all types of focus group data including the verbal and non-verbal content and interaction data. The framework is aimed specifically for IS researchers, but is also relevant to other applied business disciplines.

In the third article, the critical incident technique was used through focus groups with IT users to develop the persistence theories. The technique has been rarely used through the data collection methods other than the individual interviews method, and to date, this is the first information systems study that uses the technique through the focus group method. Lastly, in the fourth article, the diary method was a main method of data collection to test the theories. The method has been widely used in the psychology studies of an individual's decision making and behaviour, but rarely in information systems research. The article can serve as an example for the practical use of the method in IS research. The article provided detailed information on the appropriateness of the method for this research in particular, and some information on the usefulness of the method for the studies of user decision making and behaviour in general.

6.2 CONTRIBUTION TO THEORY

This section presents a summary of the contributions of the overall thesis to theory in two parts, including prevention from digital service failures (section 6.2.1) and user persistence in solving them (section 6.2.2). Each of these two parts ends with some 'new' ideas for further research.

6.2.1 Prevention from Digital Service Failures

The prevention study emphasised that preventing failures is under investigated and is a vital component of maintaining service levels in a digital service environment. It explained that IT problems can occur at different stages of the value chain of digital services, and that these problems may lead to a customer perception of service failure. The article (1) briefly explained the concept of perceived digital service failure; (2) identified the different types of technological related reasons for digital service failures; (3) developed a digital service value chain framework from literature; and (4) offered a typology of technologies and technological approaches to prevent these failures (the value chain framework was used for the purpose of developing the typology). The technologies and technological approaches were assigned to various points in the digital service value chain, and were arranged according to whether their use is the responsibility of the customer or the organisation. This paper provides a granular, theoretical grounded, service-oriented view of IT failure and failure prevention.

Some new ideas for further research:

As explained, the stages of the digital service value chain cover the operation, production and use of digital services, where both user (a customer/external user) and service provider are involved (in co-producing the service), and perceived service failures may occur for the user at these stages. Therefore, the digital service value chain framework was used in the design of the typology (i.e. the stages of the framework were considered as the criteria for categorising the prevention technologies and technological approaches in the typology). However, the stages of the digital service value chain are just a part of a bigger cycle, which is the service life cycle. According to Riedl, Böhmann, Rosemann and Krcmar (2008), who designed a service life cycle for IT departments, the phases of service life cycle include requirements analysis (e.g. analysis of functional and non-functional requirements) and design of a digital service, negotiation ("the process of describing, offering, publishing, and advertising of a service", p. 207), provisioning ("all activities necessary to prepare the actual operation [and production] of a service", p. 207), production and use, and finally, withdrawal/termination ("the life cycle is completed, when the service becomes obsolete or for other reasons is no longer provided", p. 208). A user may not have any role or may have a minimal role in the phases such as the analysis and design phase and the

service termination phase of the service life cycle; therefore, no subjective or perceived service failure occurs for the user at these stages. However, some objective failures (e.g. failures in the availability and/or accessibility) of the service can and do occur because of a poor service design or due to an inappropriate termination of the service.

Therefore, in order to maximise the reliability of digital services, future research can consider developing a more detailed service life cycle for specific digital services (e.g. for e-commerce and online shopping services) that can serve as a theoretical model and guidance for developing a comprehensive typology of technologies (e.g. prevention technologies for network failures) and technological approaches that service providers can use for prevention from such failures at any stage of the service life cycle. Therefore, research in this area can consider the questions, such as "what are the technologies and technological enablers that service providers can employ to prevent service failures at all stages of the digital service life cycle?". Future research can also consider developing innovative strategies and methodologies for collecting, recording and conducting a root cause analysis of the events/incidents of service failures (which are reported by customers and/or by service staff) for prevention of these events in future. This would build on the contribution of this thesis, and the related work of Du-Preez, Tate and Nili (2015).

6.2.2 User Persistence

The third article is a grounded study of user persistence and (1) explained the nature of IT problems and the complexity of solving them from the user's perspective; (2) distinguished between user persistence with a method of solving IT problems (method persistence) and user persistence with the overall process of solving an IT problem (process persistence), and defined each of these two types of user persistence; (3) identified and presented the factors that contribute to user persistence in solving their own IT problem; (4) developed the Theory of Method Persistence (TMP) to explain why an IT user decides to persist with a specific method of solving IT problems; and (5) developed the Theory of Process Persistence (TPP) to explain why the user decides to persist with the process (the entire collection of the methods) of solving the problem. Both theories are at individual level, specifically focus on the notion of 'persistence', and are based on data obtained from users who tried to solve their own IT problem in real life situations (not a given task or a given problem in

an experiment). The fourth article tested the robustness of the two theories using a different empirical method. It showed that how the results of the analysis confirmed the two theories.

The rest of this section presents a list of a summary of the contributions of the user persistence study (the third and the fourth articles which comprise the majority of this thesis) to theory in information systems research. These are particularly about (1) contribution to theory in the area of post-adoptive behaviour, including contribution to theoretical models of user coping and adaptation; user learning and enhanced use of IT; and theoretical studies of workarounds; and (2) contribution to motivation-based problem-solving theories in general. Please see the discussions and contribution sections of the articles for *detailed* discussions on each of these theoretical contributions. The section ends with some new ideas for further research.

Contribution to theory in the area of post-adoptive behaviour:

Contribution to theoretical models of user coping and adaptation: As discussed in Chapter 4, all IS studies which have an individual-level IT post-adoptive behavioural view have studied user's behaviours in either the situation where (1) there is a major or system-level IT event or interruption (i.e. the implementation of a new IT or a significant change made to an existing IT) by an organisation (e.g. studies of user coping and adaptation behaviours); or (2) in a normal-use situation where no IT interruption has happened yet (e.g. studies of habitualised use of IT). The findings of the user persistence study can contribute to extending the theoretical models and theories of user coping and adaptation by suggesting that (1) a user's perceived IT problem should also be considered as an IT event/interruption, and (2) the Probability of a Satisfactory Outcome [P(SO)] construct and at least some of the persistence factors that contribute to P(SO) with each of the four problem recovery methods have the potential to be placed at the secondary appraisal stage of the coping theory.

Contribution to user learning and enhanced use of IT: in the event of an IT problem for a user, user persistence in solving the problem may also contribute to user learning and enhanced use of the IT, since this persistence may result in identifying some previously unknown or unused IT features and may result in a more efficient way of interacting with the IT. Studies in this area can

explore the process of user learning and enhanced use more comprehensively by considering perceived IT problems as a type of IT interruption and by identifying that which of the four methods of IT problem-solving that were identified in this study (self-, community-, joint- and fir-recovery) can contribute more to this process.

Contribution to theoretical studies of workarounds: The findings of the user persistence study can provide some insights on how to extend our theoretical understanding of 'workarounds'. The existing definition of workaround in IS research[39] has an assumption that an individual does not follow the exact steps of a specific and known process (e.g. a known process of solving a known problem). As discussed, IT problems are usually wicked problems, which are problems where the range of options and possibilities, and the information and 'process' required to solve them are unknowable at least at the beginning of the problem solving efforts. Therefore, in order to solve an IT problem, some users may create a specific solution or process in their own mind, they may find a specific process for solving the problem in a self-help information source or may identify it through peer support or from service staff at the later stages (not as a known process at the beginning) of their problem solving efforts. Therefore, the current concept of workaround in existing IS research does not apply well to the context of solving IT problems or any other wicked type of problem. This insight to the notion of workaround can be considered by research aiming at a more complete conceptualisation of workarounds in solving IT problems.

Contribution to motivation-based problem-solving theories:

The mental evaluation process of TMP and the mental evaluation process of TPP may be adaptable for studies of motivation-based problem-solving which aim to build a theory that explains and/or predicts why an individual decides to persist in solving a real-life problem. This may be particularly useful for the real-life problems for which more than one way of problem solving (e.g. one's own efforts and seeking social support) exist and the individual is aware of them. Also, considering the 'cost factors' that were identified in this study can provide conceptual insights (by

[39] As mentioned, a workaround is "a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals." (Alter, 2014, p. 1044).

supporting a more accurate conceptualisation and measurement of expected cost factors) for these theory building studies. Also, a relevant interesting findings is that emotions (a cost factor) are consciously accessible (thus, calculable) by the problem solver and can contribute to a *'decision'* to persist in solving the problem. In fact, this is a rival explanation to the view of the studies, such as Carver and Scheier (1981), Mohr (1996) and Spielman, Pratto and Bargh (1988) which mention that emotions drive post-adoptive behaviours directly and users are not consciously aware of this effect (see the discussion section of the third article for more details).

Some new ideas for further research:

The findings of this paper may contribute to developing, extending or further clarifying new business models, such as Customer Complaint business model (where customers are expected to follow a certain process to produce and/or receive an electronic service; Kasabov, 2010) which is relevant to the self-service context and for self-recovery of problems with Self-Service Technology (SST) type of IT (e.g. self-check-in and self-check-out machines provided by a service provider, such as a library, university, supermarket, hotel or an airport). In the event of a problem with a SST for a customer (e.g. a perceived problem with a SST at a library, university, supermarket, hotel or airport), a fully resolved SST problem and gaining the knowledge to solve similar SST problems by the customer themselves are examples of a satisfactory result of solving a SST problem for the customer. On the other side, time, effort and frustration are the examples of their perceived cost of solving a SST problem by one's own. Reducing this cost and increasing the user's perceived probability of achieving a satisfactory result can boost customers' willingness to start and persist with their own efforts of SST recovery whenever a SST problem happens; thus, they contribute to customer compliance with self-recovery of SSTs. Therefore, studies of customer compliance can consider the questions, such as "what are the factors that contribute to customer compliance with self-recovery of SSTs?". It is however expected that many of the persistence factors that were identified in this study are among the factors that contribute to compliance with this self-recovery.

After decades of research on human problem solving and emphasising on the importance of persistence, we still know little about persistence and its similar concepts. For example, during the literature review for the user persistence study, I could not identify even one study with a focus on

exploring the factors that contribute to persistence in solving a problem in the broad areas of social sciences, psychology, human behaviour, education and IS. This issue became even more significant when I found that persistence and similar psychological concepts, such as perseverance, grit and resilience have been used interchangeably in many academic publications, though there are differences in these concepts. In chapter 4 we discussed that these differences relate to their conceptual theme (i.e. the necessary and sufficient attributes to define a construct), such as the size and time-scale of the problem to be solved (we reserve 'persistence' for short-to-medium term problem-solving, and suggest that 'perseverance' or 'grit' are more appropriate terms for persistence towards long term life-goals). Therefore, for a start, studies in this area can consider the questions, such as "what are the conceptual differences between persistence, grit, perseverance and resilience in (e.g. information systems: IS) education?" and "what are the factors that contribute to (one of persistence, grit, perseverance and resilience) in solving a real-life business problem (such as crisis management or conflict management in IS projects)?".

Lastly, studying human problem solving (to identify the mental processes humans go through to solve different problems) has been a research approach for many researchers in the field of Artificial Intelligence (AI) (e.g. see the original study of Human Problem Solving by Newell and Simon, 1972). Therefore, the mental process of user persistence and the contributing factors to this persistence (see the findings in chapters 4 and 5) may also be useful for AI researchers. However, as explained, a persistence process and its contributing factors can be different for different types of problems and in different contexts. For example, in this study, fun/joy was not identified as a contributing factor to user persistence in solving their own IT problem; therefore, simulating this factor and other mistakes in designing an AI may lead to consequences that no designer expects them. This also can mean that first, any threat from an AI for human may occur because of not specifying a clear purpose and context or a set of purposes and contexts for the design of that AI; second, such a threat may occur before designing a reliable and advanced enough version of the AI (e.g. consider the mistake of simulating fun/joy). Therefore, research on AI can consider the questions, such as "what are the characteristics of a reliable AI which aims at '…..'?"

6.3 CONTRIBUTION TO PRACTICE

This section presents a brief summary of the contribution of this thesis to practice on both ends of a digital service failure event, including (1) prevention from the occurrence of the events of digital service failures (the focus of the first article), and (2) encouraging user persistence (based on the findings of the third and the fourth articles).

Preventing Digital Service Failures

The study identified the technological reasons for digital service failures, and offered a typology of technologies and technological approaches for preventing from these failures at various points in the digital service value chain. The typology specifies the types of technologies and technological approaches that can be used by customers and the types of technologies and technological approaches that can be used by organisations to support prevention from digital service failures in the first place. Prevention from digital service failures can help organisations to provide high quality and reliable digital services, to maintain their reputation and to avoid negative outcomes, such as costly service failure recoveries, dissatisfied customers, negative word of mouth and even losing customers.

As explained, the stages of the digital service value chain framework (that was designed and presented in the first article) were considered as a criteria for designing the typology. The framework includes several various stages of digital service production and delivery, and various technological reasons may cause a digital service failure at each of these stages. Therefore, the designated typology can be used to guide the planning and design of robust, reliable digital services offered via many other types of IT. The typology is particularly useful for the organisations which provide various types of digital services for a large population of users. The failure prevention study bridges technical and managerial (customer service) perspectives to provide a view of the "service verticals" required to prevent digital service failures. It also presents references to resources where a more detailed technical explanation can be obtained.

Encouraging User Persistence

As already explained, user persistence in solving their own IT problem is important when the user employs any of the four methods of solving the problem. From the user's perspective, his or her persistence in solving the problem contributes to achieving a satisfactory outcome, and from the organisational perspective, such an outcome is important for maintaining their customer satisfaction and retaining their customers. The identified persistence factors and knowing why a user decides to persist in solving the problem can help organisations to design their service management programmes in a way that encourages user persistence, resolves the problems more efficiently and cheaply; and maintains their user satisfaction.

The findings show some general patterns of employing the methods of solving IT problems among the users. The focus groups and individual interviews showed that the majority of users start solving their own IT problems with some level (a high or low degree) of self-recovery efforts. Also, the data shows that community-recovery is the second frequent way of solving the problem, especially for students, as they showed less persistence with their own efforts and had a fast switch to asking for help from other students. These findings clearly show the importance of paying more attention to providing high quality self-help information for users (see the factors within self-help information quality group) and the importance of technology quality factors by designers (see the factors within technology characteristics group) for a more efficient self-recovery of IT problems. They also show the importance of peer support and interactive channels that facilitate interactions between users (e.g., Q&A sites, online discussion forums provided by a business for the users).

The rest of the section presents some recommendations for businesses on how to encourage user persistence. These are mainly about the self-recovery and community-recovery methods because of their popularity among the users.

The importance of providing easy to use and user friendly ITs: The advantages of an easy to use IT is beyond just an easier adoption of its usage. Users are more likely to persist with solving their IT problems by their own efforts, if they find the IT a simple and easy to use technology, rather than a technology interface with many features that most users do not need to use them.

Improve user's feelings of control in self-recovery of the problem: Regardless of to whom a user attributes the cause of the problem - to firm or to themselves, not having enough control on solving the problem is a barrier for the user persistence with self-recovery method. Remove any unnecessary features that limit the user's control on solving the problem. If self-recovery of certain problems does not lead to serious problems or potential threats such as a threat for system security, remove the limitations that prohibit the users from solving those problems.

The importance of high interactivity capabilities: Solving an IT problem requires user's interaction with the IT. An IT with design features that provides a big picture of the problem recovery process (e.g., troubleshooting process) and enables users to organise their actions is a significant factor that positively contributes to the user's perceived probability of a satisfactory outcome. Such an IT informs the type of problem, suggests a solution, shows the current step and guides for next steps of solving the problem, and allows for knowing what will happen if the user decides to do a certain action. In contrary, if the user does not have any idea of what they are doing or what will happen next, do not expect any result other than user anxiety and frustration that may lead to serious consequences for user persistence with the self-recovery method.

The importance of the quality of self-help information and 'how-to' contents: Dependent on the task an IT has been designed for, self-help resources can include for example a help icon on the interface, online instructions and manuals, and frequently asked questions. This self-help information must be concise, easy to understand, easily accessible and relevant to the current version of the technology in use. The information also should be contextualised, in other words, certain solutions should be presented for certain pre-defined problems all of which can be found easily by entering the keywords in the user's mind. Such quality factors of self-help information increases the probability of fast and easily finding of relevant information.

Facilitate the interaction between the users: Provide interactive channels and online community of users (e.g. Q&A sites and online discussion forums) specifically for solving IT (e.g. work and study IT) problems. Even, if possible, design the physical environment of work, service delivery, etc. in a way that facilitates interaction between users. Easy interactions between users provide the

positive feeling of being capable of receiving help from peers. The chance of asking for help from friends, colleagues or peers (i.e. community-recovery) increases user perceived probability of a satisfactory outcome. As already explained, facilitating interactions between users is more important for the younger and student IT users, as they are usually more impatient than older ones in persistence with self-recovery method and have a fast switch to community-recovery method.

Educate the users through their interactions with user support staff: The quality of user support staff performance in joint-recovery of the problem is important. It influences user persistence in solving the problem through joint-recovery method, but do not just focus on this. The interactions with users who have contacted help-desk to ask for solving an IT problem is a good chance for educating the users providing step by step guidance of how they can find relevant self-help information and use them to solve the problem. This can provide the users with useful knowledge of how to solve certain problems and improve their self-efficacy of solving similar or even other types of IT problems. This self-efficacy can boost the users' perceived probability of satisfactory outcome with both their current and future efforts of solving IT problems.

6.4 CONCLUDING COMMENTS

It is a truism to say that the future is digital. As we mentioned in the introduction to our Chapter 2, services are estimated by the World Bank to make up approximately two thirds of the total world Gross Domestic Product (GDP), and in many spheres of life, a very large proportion of service transactions are conducted digitally, and this proportion will continue to grow. Increasingly, the use of digital services is critical to our daily life, health, work and leisure. There is an onus on those who design and deliver services to make them robust and to prevent failure. This is the subject of the first paper presented in Chapter 2. However users are expected to be self-reliant in their use of digital services, and to persist in solving the problems that will occur even in the best-designed services. This is the subject of the papers presented in Chapters 4 and 5. Considered together, this series of papers offers a range of perspectives which offer significant insights for researchers and practitioners in digital service management, and for users of digital services; all aimed at improving user experience through failure prevention and persistence in digital service problem solving.

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