An Integrated User-centric Service Platform to promote sustainable behaviour

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Declaration

This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

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Abstract

In this thesis, the focus is on addressing the gaps that exist between (a) utility companies' efforts to implement and diffuse Internet-based services and (b) their goal to achieve users' expectations in terms of managing their domestic utility services online. The research highlights the importance of shifting the focus towards a user-centric and integrated virtual enterprise service delivery platform that factors in user demands and functions as a medium for interaction between all utility parties to cooperate in achieving efficient resources usage, while promoting sustainability and environmental welfare.

The research involves a critical investigation of users' perspectives related to the success of the creation of the proposed platform in the utility domains, with particular emphasis on its potential influence on user perceptions in terms of benefits, technology-fit, acceptance, and service adoption; in addition to the potential role of such platform in promoting individual pro-environmental sustainability. The research methodology design involves the collection of information (n=1142) about individual opinions, views, beliefs and expectations towards the new conceptualised innovation platform. The methodology involves four main stages. The *initial stage* was devoted to defining the research problem, conceptual model, developing a theoretical validation framework and the research questions with a formulation of the related hypothesis. This stage of the research design is critical to identify the key underpinning aspects of the research topic and to determine the main variables that have an impact on the research problem. The *second stage* involves an empirical investigation of Internet-user's perceptions of task-technology fit, new technology innovation adoption, barriers, trends and difficulties for both existing and future technology innovation as well as an electronic service delivery approach, using a quantitative questionnaire survey. In the *third stage*, a mock-up prototype system is implemented to illustrate and validate the proposed research concepts. The last *stage*, aimed at analytically validate users' perspective towards the new technology innovation platform as formulated in the research model and to predict their willingness to adopt the platform and impact on their individual sustainable behaviour.

The resulting validated model and service platform provide a means for utility companies to deliver user accepted electronic utility management services, while promoting environmental friendly behaviour.

Chapter 1: Introduction

> *Research background, motivation, problem statement, research scope, aims and objectives, researech questions, methodology, and contributions to the body of knowledge, structure of the thesis*

1.1. Research Background, Motivation and problems statement

The Internet is no longer an option but a mandatory technology that should be embraced by organisations and factored into their corporate strategy (Johnson et al., 2000, Fitzsimmons and Fitzsimmons, 2008). It is widely recognised that no other technology has so dramatically reformed business, and its ubiquitous services are broadly diffused amongst the wider public. Businesses, public institutions and private sector agencies, together with individuals realised very quickly the potential benefits that such technology can provide (Fang, 2002). The underlying advantages brought by the Internet are beyond its ability to provide information services to beneficiaries, but are rather to be found in realizing tangible real benefits, such as: better service delivery to customers, enhancement of business processes, as well as lowering costs and improving outcomes (Ancarani, 2005). It is widely recognised that the increased number of Internet-based applications that deliver electronic services (eServices) to users, especially in the private sector, have had a great impact on customer satisfaction and perception of the convenience of these services (Santos, 2003). Many customers have identified themselves as being more comfortable dealing with a technical interface that provides a flexible way of interacting via an eService rather than dealing with an ordinary face-to-face interface to acquire the desired services (Fassnacht and Koese, 2006).

The concepts associated with eServices are widely known amongst Internet users and recognised in the Internet world. According to the literature, De Ruyter et al. (2001: 186), eServices defined as "an interactive, content-centred, and Internet-based customer service that is driven by the customer and integrated with related organizational support processes and technologies with the goal of strengthening the customer-provider relationship". Another definition presented by Kim et al. (2003: 5) primarily emphasised the innovativeness of the services delivery approach, where eService is viewed as “an integrated solution for customized services that are delivered through the Internet, enabling the dynamic discovery, composition, and delivery of services". This definition suggests the important need to improve services beyond the basic definition of an eService concept when dealing with the provision of electronic services within the private sector. This is in line with the observation that, the most dominant mode of competition between private organisations is the intensive effort invested in modernising eService provision in order to attract their customers (Asgarkhani, 2005).

As concluded from the literature review, numerous recent service delivery initiatives display a major shift in their strategies from the organisational supply-side service delivery approach to a focus on ‘user-centric’ service provision, which scholars consider an important shift to cope with the user demand-side and attain their satisfaction (Botterman et al., 2003, Lassnig and Markus, 2003, Zhang et al., 2005, Christopher G, 2004, Tung and Rieck, 2005, Seifert and Petersen, 2002, Christopher G, 2005). The new emerging intelligent approach for an online service delivery paradigm in the literature has shifted its focus from the traditional provision of online service delivery to a new paradigm that is ‘integrated’ and ‘customer-centric’ by which organisations can increase the value of services delivered to their customers. In the present state, the ‘customer-centric’ online service delivery approach has a substantial role in many organisations service development strategies (Scavo, 2003, Tat-Kei Ho, 2002, Senyucel, 2007). Other studies go even further in considering the user-demand perspective as a critical determinant for the success of the online service delivery approach. In addition, they consider it useful for achieving better user technology acceptance, innovation adoption and satisfaction (Christopher G, 2004, Graafland-Essers, 2003, Hinnant and O'Looney, 2003, Wendy, 2003, Tung and Rieck, 2005).

In relation to the subject of ‘user-centric’ service delivery strategies, several studies point out the importance of considering the emerging concept of a ‘one-stop’ integrated services delivery paradigm in the implementation strategies of eServices that target the satisfaction of customer-needs. According to Maria A (2002), the integrated ‘one-stop’ service delivery paradigm can be defined as “a single point of access to electronic services and information offered by different public authorities”; noting that, “it requires all public authorities to be interconnected and that the customer is able to access public services by a single point even if these services are provided by different public authorities or private service providers. It further requires that the customer is able to access these services in a well-structured and understandable manner meeting his/her perspectives and needs" (Wimmer, 2002b, p.149).

In a similar revolution trend, the European Commission electronic service delivery roadmap recognised the need of meeting user expectations by applying an approach of 'user-centric' and integrated electronic services delivery, considering the perspective of users' demand-side in their future implementation strategy. The integration of the electronic service provision delivered to end-users allows the user to have a single-point-of-access to all these services (in other words, 'one-stop' access to integrated service provision) (Maria A, 2002, Gouscos et al., 2007, UNPAN, 2014).

Overall, the 'one-stop' electronic service delivery paradigm demonstrates its importance in playing a role in, and capacitating the creation of a virtual delivery environment that enables the elimination of existing boundaries between all stakeholders, including service providers and users. This rather favours interaction and information sharing between different fragmented parties, thus providing a comprehensive virtual service that is integrated and directed towards user needs. The emergence of a new kind of services over virtual environment offering the innovation of a single point of access to online service provision and information content can be seen as an effective bridge over the physical and logical boundaries between organisations themselves and end users.

In a utility management context, many utility agencies have worked hard to develop electronic services and interact with their customers using their own websites (for example, British Gas Company - www.britishgas.co.uk, E.ON Energy Company- www.eon.com or Saudi electricity company- www.se.com.sa). The function of these sites is to mediate with customers, providing places for information acquisition and transactions. In this traditional way, electronic service delivery is seen from the service provider's point of view, meaning that it is an activity undertaken by the service provider to provide electronic services to their customers. In this situation, the service provider takes the initiative in making electronic service provision available online and easily accessible to its customers, regardless of any difference in their preferences or demands (Ba and Johansson, 2008). It is notable that in the traditional approach to online utility services, the delivery strategies are designed primarily to add value for the service providers but do not necessarily address the benefits or demand-side of the customers or consider their perspectives (Baida et al., 2005).

In such a situation, the perceptual mismatch between service providers and customers in the current conventional online service delivery approach agendas may not fit customer expectations or be consistent with their needs. It might indeed make users more indifferent to the acceptance of, or convenience of, the electronic services provided by utility organisations, which often results in a lack of service use, adoption and motivation to continue to use such services. At the same time, we may miss the opportunity to provide the various utility stakeholders (namely, citizens, businesses, regulators etc.) with the tangible benefits that potentially arise from an increased take-up of value-added electronic services, taking account of utility service management issues.

The current trend of similar situation, shows that some organisations that have similar roles to utility providers have recently updated their service delivery agendas to focus on the user need for integrated online services provision as a crucial success factor of service adoption (Horan et al., 2006, Tat-Kei Ho, 2002). They do this by paying considerable attention to online service acceptance from users by meeting their expectations. The change in the service delivery approach is essentially emerging from the need to improve various aspects of service diffusion and user adoption (Dalziel, 2004, West, 2004b, Choudrie and Dwivedi, 2005). The evident lack of user service acceptance and low adoption found in previous studies indicate a need to include users' demands and requirements in the process of designing and delivering services (Wei and Zhao, 2005).

In the case of utility service management, stakeholders expected to be more welcome toward creation of a comprehensive integrated services delivery approach of online integrated services that have the same level of quality of services and responsiveness that they experience generally when dealing with these similar online service providers. This can be achieved through a shift in focus of online service delivery in utilities towards a holistic view that is capable of incorporating the utility stakeholders' perspective and an increased focus on user needs as an essential dimension in service acceptance, which can be expected, as a result to increase online service usage, adoption, optimisation (of user impact) and enhancement of user acceptance and satisfaction. This is considered a critical step towards providing services that actually comply with user demands and in building an online service infrastructure as a medium for interaction between utilities parties, including service provider regulators, users, government agencies and sustainable communities.

This technological revolution is tending towards a single point of access to knowledge-based information sources (Sun et al., 2014, Mohanty et al., 2014, Yamagishi, 2014), that would enable the user to interact with 'an integrated virtual enterprise utility management' innovation (or 'one-stop' utility management model), as a single point of access to utility service management and a source of knowledge-based information that will be capable of delivering value-added services to users and to all utility stakeholders (Yigit et al., 2014, Dimeas et al., 2014, Kirkham et al., 2014, Barsocchi et al., 2014).

In this research, the main focus is on the consideration of customers' evaluations of service value according to their perceived technology matches between their task activities, the benefit of online services for enabling efficient management of utility services, and how the technology innovation can be framed to deliver a better customer acceptance of online services. However, this research argues that current practices of designing eService initiatives should consider a user-centric approach that take into consideration the existence of different stakeholders' needs and concentrate more on the user perception towards the proposed services in order to ensure adequate user technology acceptance in which users perceptions are considered when directing the implementation of improvements. Thus, in this research, users' perceptions are investigated to provide a better understanding of the different aspects of eService delivery within a local context.

The importance of the emphasis on user perspectives is emerging from the literature in the field over the past three decades, that investigated customer perceptions regarding their interaction with service provider websites (McKinney and Yoon, 2002, Palmer, 2002, Reitsamer et al., 2014, Rod et al., 2009, Kang and Lee, 2010, Fan and Ku, 2010). These studies established that a large percentage of existing online customers are not satisfied with their eService experience (Bednarz, 2003, ICSA., 2001) and this in most cases led to the result that such services would be deserted by the users. The importance of customer perception lies in the fact that it is a part of the adoption process and is intimately tied to the intention to adopt new innovations. In many electronic service development initiatives, there has been a sole emphasis on technological and social factors (Senyucel, 2007), whilst lacking an understanding of the context of how technology is perceived from users who are using it.

Consequently, this thesis contributes to the body of knowledge by moving the spotlight onto the holistic view to user utility management that considers consumer needs by focusing on the customer outside-in perspective of service innovativeness that will meet their utility task management needs. It highlights the need for electronic utility services intended to benefit the customer, as well as other stockholders, and proposes an initial roadmap aimed at delivering an integrated 'one-stop' utility management solution over virtual enterprise environment. It aims to show how it would be possible to improve user experience and service usability with a holistic framework that delivers benefits to all utility stakeholders via better electronic services within the shared environment.

The research framework in this study contributes to existing knowledge by providing an understanding of the utility customer's perspectives as regards to the proposed 'integrated virtual enterprise utility management' model, including their perceptions in relation to task-technology-fit, benefits, future intention to use, and the expected effects of the technology innovation on facilitating their pro-environmental sustainability behaviour, through an investigation of utility customers' judgements towards, and willingness to, use the proposed model and the expected effects of such model attributes on user sustainable behaviour intention.

In practical terms, the aim is to theoretically investigate user perspectives towards the newly proposed innovative model dimensions and study the factors that impact on their intentions for accepting and adopting the new framework of an integrated online utility management service, as well as to determine the value of the innovation from the users' perspective. Based on the theoretical framework developed in this thesis and underpinned by several related theories including theories of task-technology-fit (TTF) (Goodhue, 1995), DeLone and McLean Modified model of information system success ('net-benefits') (Delone, 2003) , technology acceptance model (TAM) (Davis, 1985), diffusion of innovation (DOI) and perceived characteristics of innovation (PCI) (Moore and Benbasat, 1991), which is widely used in the field of information systems (Straub et al., 1999, Moore and Benbasat, 1991, Plouffe et al., 2001, Tornatzky and Klein, 1982, Van Slyke et al., 2004); this research will contribute to different aspects related to explaining the user perception of technology fit, benefits, and predict the user willingness to accept the proposed framework in a utility management context at an individual level. However, to the best of the author's knowledge, no previous studies have been undertaken in this domain that propose user-centric integrated services for utility management in a virtual enterprise environment. Therefore, this study has taken the initiative in proposing a new integrated services delivery model in a virtual enterprise environment (Thompson, 2008), that is viewed as a user-centric comprehensive solution capable of meeting user demands of achieving efficient utility management using online services in order to accomplish all of the parties' goals of promoting environmental-sustainability, energy and national utility resource saving.

1.2. The scope of the research

This research is concerned with user-centric integrated electronic utility management in a virtual enterprise environment. It is restricted in scope to the formulation of an appropriate user-centric service delivery model, along with the identification of key technological characteristic features that can inform organisations implementing a user-centric and integrated electronic services platform that focuses on user technology acceptance, services adoption, and achieving goals of promoting pro-environmental sustainability in the domain of a utility management context. The focus of this research is not on the technical implementation of the proposed framework and, therefore, the development of software or hardware is out of scope of this study. The prototype system development used in this research was used for the purposes of validating the research model. Thus, the research focuses on addressing the gaps that exist between organisations' efforts to implement and diffuse eServices and achieving users' expectations regarding adoption, use and efficient utility management. Moreover, the emphasis of this research is on the user demand side of electronic services in a utility management context when dealing with utility responsible organisations online. The empirical survey was carried out in Riyadh and it is limited to any household members of age 18 years or above, capable of using Internet services.

1.3. Research aims and objectives

The overall aim of this study is to undertake an investigation of the user's standpoint towards the creation of a 'user-centric' and 'integrated virtual enterprise utility management' framework in a utility management context. More specifically, to predict the potential influence of the proposed technology innovation on the user's perceived benefit, technology-fit, acceptance, and technology innovation adoption. In addition, the study aims to investigate the role of integration of the sustainability-related functions in the proposed model as a means to promoting individual behaviour intentions towards pro-environmental sustainability. In this research, a number of objectives related to the research aims are identified as follows:

a) Review and analyse the related literature in the area of information systems in general, with particular emphasis on literature related to the emerging electronic services delivery approach, technology acceptance, diffusion of innovation and adoption, and the role of technology initiatives in promoting individual pro-environmental sustainability.
b) Contribute to the body of knowledge in electronic services adoption in general, and in particular in the Saudi local context, by providing insights into the user adoption and behavioural characteristics with regards to existing electronic services provided by different organisations.
c) Propose a model of user-centric 'integrated virtual enterprise utility management' that is appropriate for online utility management while assisting users in achieving efficient management of all their utility services.
d) Investigate the potential role of the proposed model in functioning as a driving force assisting electronic services acceptance, adoption in a utility management context and promoting pro-environmental sustainable behaviour.
e) Develop a theoretical validation framework based on the critical analysis of related theories from the academic literature, which can be used to test and validate the appropriateness of the proposed model from a user point of view through an empirical study of their evaluation of net-benefits, technology-fit, acceptance, adoption, and the effect on their behavioural intentions towards sustainability.
f) Contribute to the body of knowledge with regards to promoting individual behaviours towards pro-environmental sustainability by exploiting the role of technology functions in facilitating sustainable behaviour.

1.4. Research questions and hypothesis

Based on the description of the research problem, this research will contribute to the body of knowledge by answering the following overarching research question:

> *"Does the creation of an online "one-stop" user-centric and integrated virtual enterprise utility management platform positively affect user perception of technology fit, acceptance, and innovation adoption, while promoting individual intention towards environmental sustainability?"*

To answer the main research question and achieve the research objectives, the following sub-research questions are formulated:

RQ 1: What are the socio-demographic, Internet use, public eService adoption, and behavioural characteristics and profile of local Internet-users in the city of Riyadh (i.e. potential users of the proposed platform)?

RQ 2: What are users' perceived technology-fit and benefits in relation to the creation of an 'integrated virtual enterprise utility management' innovation (or 'one-stop' technology innovation platform)?

RQ 3: Can a proposed model of 'integrated virtual enterprise utility management' be appropriate for utility users, and effectively accepted for utility management activities?

RQ 4: What is the expected role of the sustainability related functionality within the proposed model on the user behavioural intention towards environmental sustainability?

Research hypothesis

The research approach is underpinned by the literature review and the analysis of key findings of previous theoretical and empirical studies in the fields of emerging electronic services delivery, diffusion of innovation, acceptance of technology, and information system initiatives in promoting individual pro-environmental sustainability. In past research, to the best of the author's knowledge, no previous studies have examined electronic utility management services delivered by services providers' websites from a user perspective, overlooking the importance of providing an integrated electronic services framework targeting the facilitation of user technology acceptance, adoption or promoting individual environmental sustainability. Therefore, this study has taken the initiative in proposing a 'user-centric' integrated service delivery innovation framework with a focus on investigating customer perceptions of technology fit and intentions for accepting and adopting the new technology innovation by studying the factors of the integrated utility management services technological dimensions on the internet in order to determine the value perceptions from the users' perspective. Thus, this study is explanatory in nature and in order to conduct the research the following main and sub-hypotheses were formulated:

Main H.a: The creation of an 'integrated virtual enterprise utility management' model, reflected in a 'one-stop' platform, will positively affect users' engagement with utility services, as well as their overall perception, with a focus on 'technology-fit' and 'net-benefits'.

H.a (1): Utility users have a positive perception of the 'technology-fit' of the proposed 'integrated virtual enterprise utility management' model in line with their online utility services management needs.

H.a (2): Utility users have a positive perception of the potential 'net-benefit' outcomes of creating the proposed 'integrated virtual enterprise utility management' model in line with their online utility services management needs.

Main H.b: The user overall perceptions towards the new innovation characteristics will positively affect their intention to accept and adopt the innovation.

H.b (1): The user's 'perceived usefulness' (PUSF) of the proposed innovation will positively affect their intention towards acceptance and adoption.

H.b (2): The user's 'perceived ease of use' (PEOU) of the proposed innovation will positively affect their intention towards acceptance and adoption.

H.b (3): The user's perception of the innovation's 'compatibility with [their] prior experience' (CMPE) will positively affect their intention towards acceptance and adoption.

H.b (4): The user's perception of the innovation's 'compatibility with [their] values' (CMPV) will positively affect their intention towards acceptance and adoption.

H.b (5): The 'other use' (OU) experience with technology innovation will positively affect their intention towards acceptance and adoption of the innovation.

H.b (6): The user's perception of the innovation's 'communicability' (CMU) will positively affect their intention towards the acceptance and adoption of the innovation.

H.b (7): The user's perception as regards to the innovation's 'measurability' (MSA) will positively affect their intention towards acceptance and adoption of the innovation.

H.b (8): The more "trialable" (TRI) the innovation is from the user and service perspectives, the more positive the effect on their intention towards acceptance and adoption of the innovation.

Main H.c: The sustainability-related functionality integrated within the proposed research model will positively promote users' future 'behavioural intention' (BI) towards pro-environmental sustainability.

H.c (1): The integrated sustainability related functions (integrated within the research model) positively affect user's 'attitude' (ATT) towards pro-environmental sustainability.

H.c (2): The sustainability related functions (integrated within the research model) will positively affect user's 'subjective norms' (SBN) in relation to pro-environmental sustainability.

H.c (3): The sustainability related functions (integrated within the research model) will positively affect the 'perceived behavioural control' (PBC) from a user point of view in relation to pro-environmental sustainability.

Chapter four presents detailed information on how these hypotheses are underpinned by the literature of related fields as well as the development of the theoretical framework to investigate the proposed model in terms of user acceptance, adoption, technology-fit, potential net-benefits and effects on promoting their pro-environmental behaviour intentions. Table 1-1 provides a map between the research questions and hypotheses with information on related thesis chapters.

Table 1-1: Summary table for meeting the aim, objectives and questions of the thesis

Research Question	Topic	Hypotheses Number	Thesis Chapter
RQ 1	Saudi local Internet-user profile (socio-demographic, Internet use, public eService adoption, and behavioural characteristics)	------	Chapter 6
RQ 2	Users' perceived technology-fit and benefits in relation to the creation of the proposed platform.	**Main H.a:** (H.a (1) and H.a (2))	Chapter 2,3, 5 and 6

Research Question	Topic	Hypotheses Number	Thesis Chapter
RQ 3	Proposed platform effects on user technology acceptance and adoption	**Main H.b:** (H.b (1), H.b (2), H.b (3) H.b (4), H.b (5), H.b (6), H.b (7) and H.b (8))	Chapter 2,3 and 7
RQ 4	Expected role of the sustainability related functionality within the proposed model on the user behavioural intention towards environmental sustainability	**Main H.c:** (H.c (1), H.c (2) and H.c (3))	Chapter 2,3 and 7

1.5. Methodology and research approach

According to Gill and Johnson (1997: p.39), a research methodology design can be defined as "a blueprint that enables the researcher to structure a research problem in such a way that the outcome is the production of valid, objective and replicable answers". The design of this research was identified as descriptive, explanatory and predictive in accordance with the nature of the research. The research design will include a descriptive study in its initial phase to describe the user perception towards the research problem and to ascertain an understanding of the characteristics of each variable of interest to the study. The following part includes explanatory research in order to test a hypothesis of user technology acceptance and the expected effects of the research framework on individual sustainable behaviour with a view to developing a model that can contribute to technology adoption and encourage an individual's sustainable behaviour in a utility management context.

In this research study, user adoption of the new technology innovation and associated electronic services in a utilities domain will be researched from a positivist perspective because it is consistent with the context of the research problem and nature of the topic. According to Myers (2013) and Clarke (2000), the dominant epistemological approaches applied in information system research and particularly research in the electronic services business domain are the positivist and interpretivist paradigms. The capabilities provided by the positivist perspectives, such as paying a degree of attention to the problem detail, accuracy and comprehensiveness, make it relevant to this research. Applying such a paradigm can help this study to produce results that are reasonable, sufficient and open to objective evaluation based on accepted standards.

A research design that is based on a positivist view includes the selection of the research strategy, measurement instruments, data collection and data analysis methods to conclude research findings (Cavana et al., 2001). As part of the research methodology design, a quantitative data collection method will be used to achieve the objectives of this research (as described in section 4.5), which is deemed the most appropriate method with regards to the nature of the research questions (Zikmund, 2010, McDaniel and Gates, 1996). It will be employed to gather the relevant data required to test the research hypothesis and to explain the relationship among research model variables (Straub et al., 2005, Bélanger and Carter, 2008, Gefen et al., 2002, Lee et al., 2005, Warkentin et al., 2002, Moon and Kim, 2001).

According to Saunders et al. (2008), the research strategies are survey, case study, experiment, grounded theory, action research and ethnography. In accordance with the research question and nature of the measurement constructs, it was identified that a questionnaire is the most suitable data collection method. In this study, the main objective is to investigate the individual perspectives regards the new technology innovation model and their intentions to use the innovation, as well as their evaluation of the model's potential influence on their behavioural intentions towards sustainable behaviour. The scope of the research work involves the need for collecting a large amount of information about individual opinions, views, beliefs and expectation towards the innovation framework conceptualised in the research model. In line with analytical method requirements that will be applied in the data analysis phase of this research, a survey will be conducted to obtain enough data from the sample population. Based on the nature of the research problem, research questions and purpose, it is deemed essential that the chosen research strategy should support the procurement of a large number of participants' opinions. According to Hair et al. (2003), questions about individual opinions, attitudes and beliefs are the most appropriate for collation using a questionnaire. Furthermore, a survey instrument is the most common and dominant design strategy in this field (Karanja and Zaveri, 2013, Mohan and Ahlemann, 2013, Palvia et al., 2003) and is considered the most economic, structured and practical method of collecting large amounts of data from a large sample size of population (Hair et al., 2003).

In this research, the potential for user acceptance of an "integrated virtual enterprise utility management" platform is explored through a theoretical framework derived from the related literature and underpinned by theories of same domain. Figure 1-1 highlights the main research methodology design and describes four main methodological aspects: a) features of the ICT approaches, model and technological characteristics that form the proposed platform; and, b) base theories employed to formulate the theoretical framework in order to validate the research model and investigate the user the perspectives, c) research methodology process of multi-stage design and d) research outcomes. A multi-stage design of the research process was chosen to tackle the research problem and answer the research questions. According to Creswell (2013), the stages of the research process are a set of "sequential procedures, which the researcher seeks to elaborate on or expand the findings of one method with another method". It is essential to define the research design methodology from an early stage in a proper way in order to provide guidance for the following research steps. The intended research design process of this study will be conducted in order to achieve the objectives of the research by identifying the research problem, research methods and data analysis techniques. In this research, a sequential "stages of research design approach" was identified as appropriate for answering the research question. The research was structured in four stages: a theoretical stage and three other empirical stages, as depicted in Figure 1-1 with their order in logical sequence.

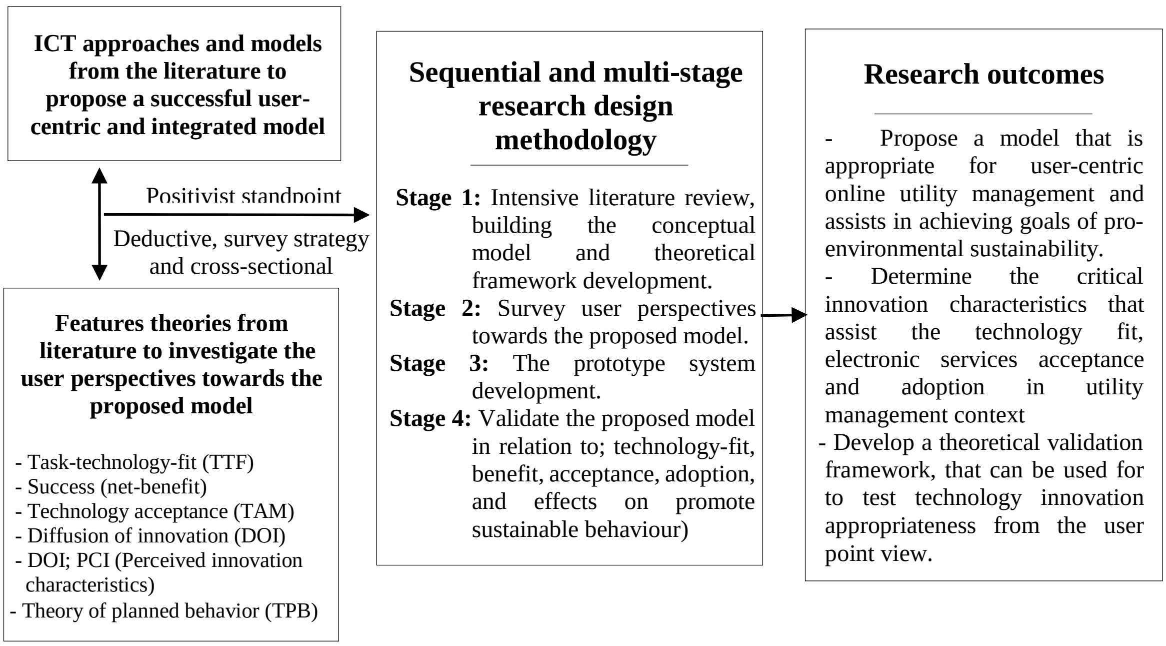

Figure 1-1: Research methodology design

1.6. Research contributions to the body of knowledge

This research presents several significant contributions to different areas of the body of knowledge ranging from improving electronic service delivery strategies, technology acceptance and adoption, to the extent of promoting individual sustainable behaviour. Firstly, the aim is to build a model that can inform e-organisations of the importance of implementing a user-centric and integrated electronic services platform that focuses on improving user technology acceptance and services adoption in a utility management context. This research identifies and addresses gaps that exist between utility organisations' efforts to implement and diffuse eServices and users' expectations for use and willingness to adopt these services.

In practical terms, this research contributes to the body of knowledge by proposing a user accepted integrated virtual enterprise platform that would enable responsible organisations to have a means of providing online utility management services to utility users, in addition to providing a comprehensive understanding of the different dimensions affecting existing initiative's success and an elaboration of the move towards implementing the successful integrated electronic services framework so that technology acceptance can be achieved. The contribution of the proposed model in this research will serve as a framework for the further development of a comprehensive virtual enterprise platform beneficial to all utility parties, with a view to achieving the ultimate goal of promoting environmental sustainability.

By considering the recent revolution of online services delivery strategies and the range of adoption and diffusion models; technology acceptance model (TAM) (Davis, 1985), diffusion of innovation (DOI), task-technology-fit (TTF) (Goodhue, 1995), DeLone and McLean Modified model of information system success (Delone, 2003) and perceived characteristics of innovation (PCI) (Moore and Benbasat, 1991), as well as finding one that suits the online utility management context, this research will provide a theoretical contribution to the body of knowledge, since, to the best of the author's knowledge, there is no theoretical model that has as yet been suggested as appropriate for this particular context. Therefore, this research will contribute theoretically and methodologically to the literature related to the research areas of electronic services delivery, adoption and diffusion of innovations approaches.

With regards to the nature of the research subject (i.e. the proposition of a user-centric and 'integrated virtual enterprise utility management' platform), the research outcome will make a major contribution to this research field and literature in this domain, in particular to the literature related to pro-environmental sustainability. This is a worthy outcome since one of the aims of formulating the framework is the promotion of individual behaviour intentions towards sustainability. Raising awareness and knowledge, improving the role of technology innovation, and its capacity to engage utility consumers in sustainability issues, will contribute towards this goal.

1.7. Structure of the thesis

This thesis is outlined and structured to include seven interrelated chapters. A brief summary of the content of these chapters is summarized in the following sentences and illustrated in Figure 1-2.

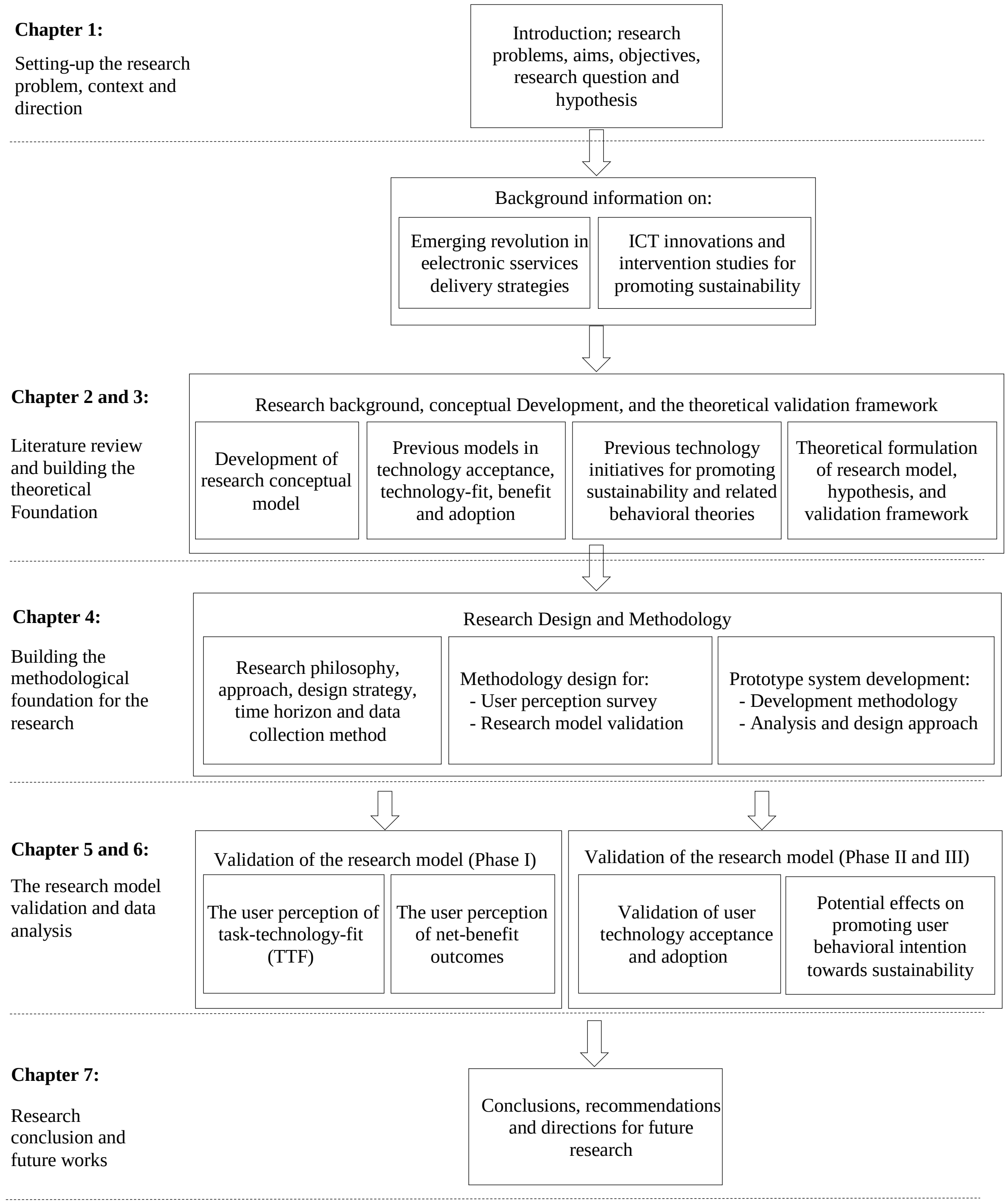

Figure 1-2: The research structure and chapters components

The detailed outline of the contents of these chapters can be summarized as follows:

Chapter One: The first chapter introduces a general informational background about the research motivation and the problem domain. It provides brief information on the scope of the research and a rational justification for conducting the research in the area of interest, and it discusses the need for the developed one-stop integrated utility management model and platform. It introduces an overview of the associated research aims and objectives, research questions, hypothesis as well as the methods used, by which these objectives can be achieved. This is followed by a brief outline of the expected research contributions to the body of knowledge and concludes with details of the structure of the thesis chapters.

Chapter Two: This chapter reviews the related literature in the research domain. It starts with a detailed background of the emerging future trends in electronic service delivery strategies over the Internet. This is followed by addressing a number of aspects, which underpin the work and are related to the research domain and the concept of a user-centric and integrated online services framework in a virtual enterprise environment (or 'one-stop' service delivery paradigm) for utility management activities. It also identifies the technological dimension and sustainability-related functionality that will be associated with the proposed model as informed by related literature.

Chapter Three: This chapter presents the second part of the literature review providing a theoretical background from previous studies to underpin the theoretical framework that is used as a basis for validating the proposed research model. It describes the main focus of the research underpinning the various components of the proposed conceptual research model from related literature, where the literature review is motivated by the need to examine different user perspectives as regards to the innovative model proposed in this thesis. This is followed by a detailed formulation of the theoretical research framework used for the purpose of validating the proposed conceptual model. The chapter reviews prior literature, theories and empirical studies in the related fields including, TTF, the technology acceptance model (TAM), diffusion of adoption (DOI), PCI and behaviour theories to develop an appropriate theoretical framework for evaluating the research conceptual model from the user perspectives. Along with the theoretical framework, this chapter presents a formulation of the associated research hypotheses that will be tested to achieve the objectives of the research.

Chapter Four: This chapter presents the research methodological design process that will be employed to achieve the research objectives and obtain the study results. This chapter describes the development of the empirical research design approach utilised to validate the research conceptual model and to test the associated proposed hypotheses. It also serves to justify the appropriateness of the selected methodology design approach of this study in accordance with the research context and problem under investigation. This chapter starts by presenting the dominant research paradigms with an overview of the research methodologies as well as their advantages and disadvantages, in order to build a philosophical basis for the research paradigm that will be employed in this research. It will then explain and rationalise the selected research approach, research strategy, time horizons, survey strategy, and data collection method. This is followed by presenting the research design process of four major subsequent phases that were designed to answer the research questions. The last section introduces the methodology for the data analysis process, describing the employed analytical techniques in each data analysis stage of this study.

Chapter Five: The primary goal of this chapter is to evaluate the user perceptions towards the creation of an ‘integrated virtual enterprise utility management’ platform (or 'one stop' model) and the associated eService delivery approach within the proposed model. To achieve this goal, this chapter starts with general descriptive information drawn from respondent profiling. It includes descriptive statistics of respondents’ socio-demographic characteristics, their behaviours associated with using the Internet, and their behaviour in relation to public e-Service usage. It was found to be essential to survey the technological and behavioural context related to the research question and to build a profile of Internet users in a local context before investigating the users’ perception towards the proposed research model. Next, the chapter presents the data analysis results obtained from different statistical techniques, ranging from simple to advanced analytical methods, in order to explore, summarise, and interpret the data that provides insightful understanding into the respondent’s perspectives across all the core components of the proposed conceptual framework from ‘technology-fit’ to the expectation of ‘net-benefits’ with a particular emphasis on the role of TTF on user perceptions of technology innovation benefits. This is an essential step in the confirmation of the overall user perception with regards to the technology innovation features of the research framework conceptualised in this study and in testing the pertaining research hypotheses of phase I of this study. The final part of this chapter summarises the findings of the data analysis and hypothesis testing results with an aim to develop a more comprehensive, user-centric, integrated and accurate online services delivery model in a utility management context and to present a logical framework that facilitates further development of technology innovation that will be more user adapted.

Chapter Six: This chapter presents the data analysis findings of the two validation phases of the research model (I and II), as formulated in the theoretical validation framework which includes the measurement dimensions of: i) the user's technology acceptance in relation to perceived innovation characteristics; and, ii) their expectation of the model's effects on their pro-environmental sustainability behaviour. More specifically, it presents the findings related to six attributes of a users' intention to adopt the proposed model, which are: compatibility with prior-experience, compatibility with values, measurability, communicability, others' use and trialability, in addition to three other behaviour related measurements of the expected effects of the model on their intentions towards sustainability. This chapter concludes with a brief summary of the findings and the results of the hypothesis testing, which aims to assess whether each of the model components, comprising the conceptual framework, is related to the users technology acceptance, perceived innovation characteristics and an effect on their sustainability behaviour.

Chapter Seven: This chapter summarises the research findings and potential contribution to the body of knowledge provided by answering the research questions and testing the associated hypothesis. It summarises the thesis findings and suggests several future research directions. It discusses the overall research contribution with final conclusions and recommendations.

1.8. Summary

This chapter presents an overview of the research, its informational background, motivation, rationale of the research, scope and contribution of the research, objectives, and hypotheses, as well as the research questions. This chapter aims to provide the readers with a comprehensive overview before detailing the research process, including outcomes, in the subsequent chapters.

Chapter 2: Literature Review – part I;

> *Emerging revolution in eServices delivery paradigm, background information on 'one-stop' concepts, technology role in promote sustainability individual awareness, behaviour change, and as persuasive technology for encourage individual pro-environmental behaviour*

2.1. Introduction

This chapter presents the literature review (Part I) to discuss the area of eServices and its fundamentals concepts, emerging revolution in services delivery approaches, and background information on the 'one-stop' services delivery paradigm and the associated concepts. In addition, it discuss numerous aspects related technology role in promoting individual awareness, behaviour change, and as persuasive technology for encourage individual pro-environmental sustainable behaviour. In the review, the chapters focus on scholars' and practitioners' attempts to use technology features on promote saving resource consumption and individual sustainability. It provides a basis information for underpinning the theoretical and empirical work of this research.

2.2. Emerging revolution in eServices delivery approaches

Electronic service delivery has been described as an important attribute for online business (Lohse and Spiller, 1998). Several applications of electronic service provision are implemented in private and public organizations (e-government, e-commerce, e-heath, etc.). The service delivery approach adopted depends primarily on the revolution of techniques in recent service delivery approaches and organizational strategies for establishing their presence online, as well as how it can attract their customers and satisfy their needs.

In past years, private and public organizations have been spending considerable time, resources, and efforts to create online service applications. Such applications offer electronic services to meet customers' needs in an interactive, customized, and more responsive manner, thereby assisting businesses to create more valuable customer relationships and achieve better competitive advantages (Chidambaram, 2001).

When the process of deploying web-based applications was in the beginning phases, organizations were not aware of the potential these services had for benefitting the organization due to their lack of data, knowledge, and expertise. The focus of organizational efforts was on providing customer services, and very little efforts were made to assist in the success of shifting to online services against the benefits achieved when electronic services were adopted by the customers.

However, businesses have now gained the relevant information to run better user-adopted electronic services, through which they can determine what kind of electronic service delivery strategies are beneficial to those aspects of business goals. The need of businesses to further enhance their electronic services development to gain wider user acceptance is becoming urgent as they have now acquired many years of experience in developing electronic services provision (Lu et al., 2006).

Recent advances in information and communication technologies have accelerated the development of electronic services, which include electronic systems that use different technology and service delivery methodologies. These services are provided by different kinds of organizations and involve different applications to interact with users online through e-government, e-business, e-learning systems, e-payment, e-marketing, and e-commerce. The electronic services range from basic services, including delivering information, news, and communication services, to intelligent services, such as delivering context-aware services (Chidambaram, 2001).

Most governments and organizations in developed nations that have advanced web-based service environments have passed through three stages: (a) presentation of electronic information, (b) online transaction, and (c) integration of electronic information and services (Lu et al., 2007). The final stage an integration of all services being provided by the same agency, different agencies, or organizations of private agencies that might be involved considers providing electronic services in an integrated manner.

Customers prefer to get information and complete electronic service solutions without the hassle of getting in touch with different agencies or layers of organizations (Wimmer, 2002a, Wimmer, 2002b, UNPAN, 2014). They also desire to get personalized/customized solutions that save them from the issue of services or information overload. Due to the recent revolution in services delivery of internet technology, intelligence is a keyword leading the paradigm shift in online services (Lu et al., 2007). This will also be a result of customers' preference to access electronic services in a seamless manner through a 'one-stop' solution, and organizations' ability to deal with such a single window of electronic services delivery.

The subsequent paradigm shift in technology has sought to improve the different quality aspects of electronic services like adaptation, customization, decision support, and reliability by employing the latest service delivery technologies (Kohlborn, 2014, UNPAN, 2014). Through these recent technologies, organizations offer more user-friendly services to provide intelligent services for user-centric information presentation, personalized services provision, recommendations, contextual awareness, and decision support applications. Intelligent services have been used in various areas to create intelligent online services for various applications in e-government, e-commerce, and e-health applications. In services personalization, web users' information is acquired online and then used to provide web pages and services to customers according to their preferences. This process of the personalization of services aims to meet the needs of the web users more successfully and efficiently, in addition to making online communications faster and more convenient, thereby enhancing online users' satisfaction, resulting in continuous use of these services or repeated visits (Bonett, 2006, Riecken, 2000b). These services are rapidly being applied in recent development areas of e-government, e-commerce, e-banking, and e-learning (Adomavicius and Tuzhilin, 2005).

According to researchers, more personalized mechanisms and technology are advanced development that required to be used in electronic services, especially in four essential areas namely, user profile, information content, navigational link, and recommendation as these constitute fundamental techniques for electronic services personalization (Adomavicius and Tuzhilin, 2005, Eirinaki and Vazirgiannis, 2003).

It is well-recognized that, in the emerging intelligent approach to electronic service delivery, the focus has shifted from the traditional provision of online services to the customer to a new intelligent and integrated services approach by which organizations can increase the value of their services to the customer. For example, in e-government (a similar application of electronic services applications), there is an emerging need to adopt a new approach for delivering electronic services to public users; consequently, e-government strategies are updated accordingly (Nations, 2010). In other similar directions of this application, the European Commission's electronic service delivery roadmap highlights the need for a service delivery approach that meets users' expectations by applying the intelligent electronic services delivery approach that considers the users' demand-side in future implementation strategies.

In response to users' needs, others studies (Botterman et al., 2003, Lassnig and Markus, 2003, Zhang et al., 2005, Christopher G, 2004, Tung and Rieck, 2005, Seifert and Petersen, 2002, Christopher G, 2005) show a shift in focus in their service delivery strategies from the organizational supply-side point of view to user-centric service provision, which scholars consider as an important shift, highlighting the importance of electronic service delivery that focuses on users' service demand side. Other studies go further in considering the user demand perspective as a critical determinant for success of online service delivery approaches that can be used to promote user technology acceptance and innovation adoption (Christopher G, 2004, Graafland-Essers, 2003, Hinnant and O'Looney, 2003, Wendy, 2003, Tung and Rieck, 2005).

A lot of research has been carried out to assess electronic services from different perspectives through different methods. This has come about through the increased need to promote online services' quality, adaptation, and usability features, creating a growing interest among researchers to assess and evaluate the methodology of developing the electronic services applications (Wade and Nevo, 2006, Schubert and Dettling, 2002). The research in electronic service provision identifies four major areas for assessment: (i) involve the assessment of the features, functions, and usability aspects of electronic service application as seen by the perspective of the user; (ii) measure customer satisfaction using different criteria for evaluating the level of customer satisfaction with electronic services' fulfilment of their customer needs (Schubert and Dettling, 2002, Awan and Singh, 2006); (iii) acquire feedback from customers and measure their level of satisfaction with the services being offered (Lu and Lu, 2004); and (iv) evaluate electronic services using a cost-benefit analysis of the agencies, such as justifying the benefits businesses expected from the development of electronic service applications as argued by (Drinjak et al., 2012) or e-business investment evaluation of electronic services as written by (Giaglis et al., 1999).

A challenge facing organizations is users' increased demand for electronic service applications, including the types of features that should be added to the technology to satisfy customers. The extent and scope of electronic services development are wide and offer diverse features, including service quality, accessibility, website interactivity, personalization, and security, among others. Furthermore, as there is no face-to-face interaction with the users, the conventional ways of gauging service quality are inadequate for measuring electronic service quality or user satisfaction (Van Riel et al., 2001).

Evaluating customer satisfaction (second category) by considering the users' demand perspective indicates that the provision of electronic services delivered from the service providers does not meet users' expectations or match their needs. Indeed, a considerable gap exists between the supply of public electronic services and users' demands. Recent studies have highlighted a critical success factor for electronic service delivery methodologies that primarily rely on the importance of considering the customer perspective in designing the electronic service delivery strategy. One previous study (Botterman et al., 2003) demonstrated that electronic service delivery success requires the users' recognition and acceptance of the relevance of the value proposition being offered and thus the degree of fit between supply assumptions and usage drivers and subsequent provision and adoption is of critical importance.'

The more successful public online service delivery strategies are, the more focused they are on measuring the benefits of electronic services for the users. In the recent intelligent electronic service delivery agendas, understanding user perception and intention to accept these services is essential for building a successful electronic services delivery model.

2.3. 'One-stop' service delivery paradigm: The underpinning concepts

An earlier study of the 'one-stop' online service delivery approach (Maria A, 2002) described the concept as 'a single point of access to electronic services and information offered by different public authorities', noting that 'it requires all public authorities to be interconnected and that the customer is able to access public services by a single point even if these services are provided by different public authorities or private service providers. It further requires that the customer be able to access these services in a well-structured and understandable manner, meeting his/her perspectives and needs (Chatzidimitriou and Koumpis, 2008).

The most interesting aspects of a 'one-stop' service are service operability and integration (Maria A, 2002). This refers not only to interoperability and integration between electronic service providers, but also to the categorization and integration of electronic services and information contexts at the abstract level according to the essence of the online service and information content itself (Kohlborn, 2014). In some cases, this has offered the ability to deliver services to certain end users in the form of 'one-stop' electronic service provision that is, delivering all the electronic services that they might require, regardless of the structures of the individual service providers or their electronic service delivery schemes (Wimmer, 2002b).

The concept of 'one-stop' service delivery enables the end-user of having a unified provision of services and information using collaborative and integrated platform (Wimmer, 2002b). According to Hagen and Kubicek (2000), reports studying the e-government in eleven Europeans countries, reveals that the public electronic services is highly fragmented and, yet not meet a citizens' expectations, and suggesting the transformation to the 'one-stop' e-government platform (Figure 2-1) as key solution for providing better services integration, fast delivery, and wider acceptance and accessibility from the citizens.

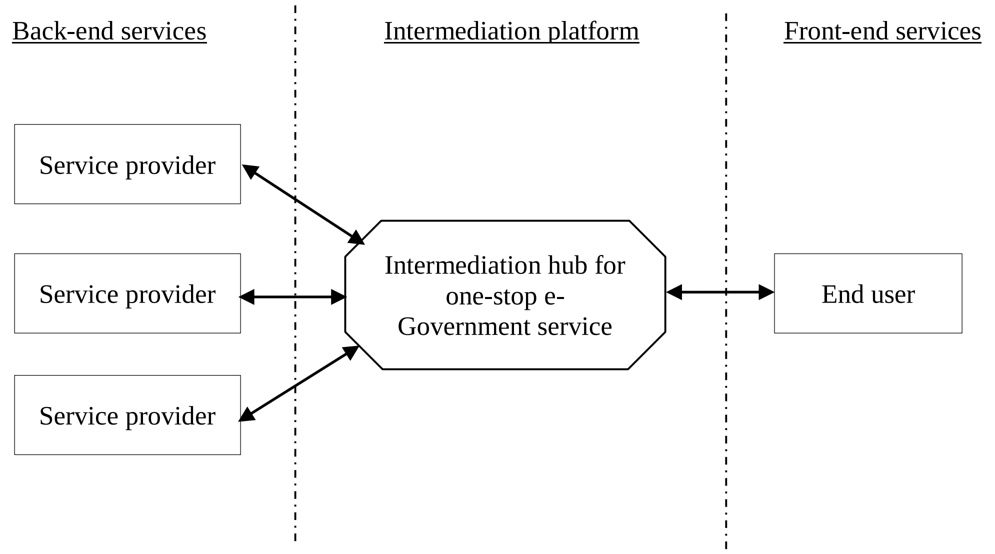

Figure 2-1: A one-stop e-Government service intermediation platform as depicted by Gouscos et al. (2007).

In this context of utility management and eService delivery paradigm, the providers are facing challenges in delivering acceptable, useable, and more adaptable public electronic utility services to their customers. The current fragmentation of utility service management processes is likely to make it more difficult for households to pursue their goals of utility management to achieve efficient resource consumption (Chan et al., 2008), while saving energy and costs as these processes are inconsistent and consume both time and effort. Indeed, households might not be satisfied with the results. These are considered the major obstacles facing the functioning of the online management of utility resources and energy / carbon reduction.

The existing gap lies in the differences in various utility organizations' perspective when developing online services. In the current situation of online utilities, service provision and energy management functions are based on different providers' perspectives and service delivery approaches and priorities, which in turn stem from variations in their goals and strategies as well as their priorities as to the benefits of their service provision.

Furthermore, in response to the need to facilitate the comprehensive management of home functionality from a single point of access, scholars have formulated the concept of integrated smart-home applications (Aldrich, 2003). Smart-home applications monitor, control, and interpret data for the household, matching the gathered data with users' predefined targets. Their functions are bundled into single windows that include home automation applications (Röcker et al., 2005, Ha et al., 2006), household energy control (Shah et al., 2009), and other applications of interest to households, such as appliance controls, environmental-sensing devices, and the consumption of utilities resources. One of the functions of smart-home applications is to deliver an innovative a central application that enables users to control home devices and sensors according to predefined rules and targets, which in some cases are initiated by the households themselves (Zhang and Brügge, 2004). Another perceived function is to monitor and control the energy consumption of appliances (Jahn et al., 2010). Furthermore, an integrated central utility management functions would facilitate the engagement of ordinary people in environmental sustainability initiatives and encourage them to be more active in relation to energy savings as well as participating in managing their resource consumption efficiently (Aman et al., 2013).

Yet, the current electronic service delivery paradigm limits users from benefitting from the use of existing online services because of the increased effort needed to carry out the utility management tasks on their property and the inconvenience of dealing with fragmented electronic services. The problems associated with users' benefits and needs do not usually apply to only a single utility authority or organization. However, the users face the absent of integrated interface that enable the interaction with single service management interface that support the functions of defining user targets as well as manage utility resource use and monitor energy consumption. They also facing a difficulty in having a control over resource usage of all utility services on their property. To do so, in the present situation, they are required to interact with several information sources via the Internet portals of several utility organizations, which offer fragmented and provider-specific electronic services. Such a situation requires different methods of accessibility to different service provider portals to interact with the desirable online utility services provision, which are scattered and in some cases duplicated and usually have different authentication processes as well. Such obstacles emerge from the absence of 'one-stop' services delivery approach, that enable the user to interact with a single point of access to utility management services as a source of eServices provision and knowledge-based information repository that can deliver value-added services to households and all utilities stakeholders.

In the subsequent section 2.4, a literature of related aspects of relationship between technology and individual sustainability behaviour in context of this research will be presented.

2.4. Technology and Individual sustainable behaviour

The following sections will demonstrate a different subject of interest in relation to role of technology in effecting individual pro-environmental sustainability. It discuss Individual utility resource consumption behaviour and effects on sustainability and the importance awareness on behavioural effects towards sustainability and focus on highlighting previous research efforts pertaining to the employment of technology innovation having an impact on individual pro-environmental behaviours and, thereby to aspects of sustainability. Section 2.4.1 will present a brief introductory section to individual behavioural effects on sustainability. Section 2.4.2 explores the effects of sustainability awareness on individual pro-environmental behaviour and resource conservation. In the last two sections (2.4.3 and 2.4.4), the literature review of the role of technology innovation in promoting individual behaviour towards sustainability was argued and related efforts from previous studies were outlined.

2.4.1 Overview of Individual consumption behaviour effects on sustainability

In a previous report from the intergovernmental panel on climate change (IPCC), it was clearly reported that human behavioural activities are the primary cause of CO_2 emissions and result in the climate change and global warming problem (Mt, 2012). Previous empirical research efforts contributing to pro-environmental sustainability development have mainly focused on strategies and actions that would serve to lower environmental impacts through an updated infrastructure that would be more sustainability efficient, in which such actions can support environmental sustainability and minimise resource consumption (Davis and Challenger, 2009). It is notable that a lesser consideration has been given to the role of individual behaviour related aspects and their impact on environmental and sustainability development. However, given the belief that environmental sustainability is mainly affected by human behaviour (Oskamp, 1995, Oskamp, 2000a, Oskamp, 2000b), it is evident that such issues can be resolved by dealing with individual behaviour change.

On the same subject of individual sustainable behaviours, individual behaviour at home and natural resources consumption have been an area of research focus within social science and environmental sustainability studies. Climate change and global warming were the main motivation for exploring individual behaviours in relation to sustainability improvement issues (Gardner and Stern, 2002). Individuals at home represent the target group for researchers dealing with the mitigating environmental problems, where the households in previous studies were assumed to be the main contributors to the environmental and CO_2-emission problems. For instance, in some pro-environmental statistics, US households contribute to 21% of US energy-related CO2-emissions.

Additionally, the utility resource consumption related to CO_2-emissions have increased by 3.3% annually (US Department of Energy, 2013). In a similar trend, Western European households contribute to 15% to 20% of overall energy consumption (Biesiot and Noorman, 1999). For the goal of selecting the most appropriate sustainability behaviour changes, individuals at home are thought to be an important factor to be targeted for behavioural change. For example, the households in OECD countries acquire 15 to 20% of the total energy of OECD countries (OECD, 2001). Energy consumption at home occur in direct and indirect ways (Vringer and Blok, 1995). Direct consumption refers to the immediate use of energy resources such as gas, electricity and other natural resources. Indirect consumption relates to the use of energy by indirect means by individual activities at home. For instance, the reflection of individual consumption of hot water at their premises on the overall electricity consumption, which increases accordingly.

However, individual resource consumption differs according to individual activities and reasons for usage, which consequently affect their total amount of resource consumption (Becken et al., 2003). There are number of aspects of this concern that have major effects on individual conservation behaviour, including: 1) the individual's prior knowledge and awareness of the importance of sustainable resource conservation behaviours with support of the appropriate means to perform such behaviours, 2) an individual's motivation to change to better sustainable behaviours, and 3) their ability to carry out such relevant behaviour (Kumar, 2012). In most situations individuals are aware of the associated issues related to their energy consumption and are also concerned about these issues (Abrahamse, 2007c) whilst remaining unclear about the actual causes of such problems (Bord et al., 2000). In addition, they are unaware of the relationship between energy consumption and their behaviour (Baird and Brier, 1981, Schuitema and Steg, 2005). Furthermore, they are unaware of the unobservable amount of waste that results from indirect energy consumption (Schuitema and Steg, 2005). While there is increased interest in the development of efficient energy buildings, the consumption behaviour of individuals at home is essential in the pursuit of more sustainable methods. It is also important to raise individuals' awareness by providing them an access to information about their energy consumption at home. According to Palmbrog (1986), a minimum of 10% of the total consumption can be reduced by targeting individual behaviour change (Palmborg, 1986). Most previous studies suggest that individuals are an essential part in the improvement of a sustainable environmental action plan, and about 40% of total energy consumption occurs in the home (Ketola, 2001).

2.4.2 Effect of individual awareness on consumption behaviour

Developments in the study of utility resource conservation behaviour has led to a desire for a greater understanding of environmental problems and utility resource conservation issues from the perspective of individual behaviour (Baek and Lee, 1987). In previous studies (Hogan and Paolucci, 1979), researchers have assumed that individuals were more informed about environmental issues and held positive views of utility resource conservation. In such a case, individuals are self-motivated to take on board responsible activities with environmentally sustainable behaviours in mind presuming they have enough information and the ability to deal with those particular issues (Hogan and Paolucci, 1979) .

Previous studies have also focused on validating the link between individual attributes, awareness, attitude and behaviour with regards to pro-environmental sustainable behaviours and acknowledged a significant relationship between individual awareness and attitude (Birch and Schwaab, 1983) (Hsu and Roth, 1996). A relevant study conducted by Lee et al. (2008) suggested that a greater individual awareness regards energy consumption occurring at home leads to a positive effect on their pro-environmental behaviours. In addition, a study by R.B. Peyton (1980) indicates that there is a relationship between individual attitude, awareness and their behavioural determinants. Further studies have stated that individual awareness of resource consumption issues is considered as an important factor that can effect environmental behaviour and actual resource consumption (Verhallen and Van Raaij, 1981, Marcinkowski, 1988, Sia, 1984, Sivek, 1987). They also, pointed out that there is a significant relationship between resource conservation behaviours and other variables, such as individual awareness, social characteristics and attitudes towards environmental conservation behaviours (Claxton et al., 1983, Gladhart, 1977, Gladhart and Roosa, 1982, Hogan and Paolucci, 1979), (Sivek, 1987, Brandon and Lewis, 1999, Ramsey and Rickson, 1976, Poortinga et al., 2003).

One of the fundamental challenges facing sustainability development and resource conservation is how individual conservational behaviours can be promoted by raising individual awareness and increasing concern regards the consequences of energy consumption as well as how to support sustainable behaviour changes (Baird and Brier, 1981).

Previous studies (Abrahamse et al., 2005), have applied different approaches towards the goals of motivating individual resource management and sustainable behaviours focusing on encouraging individual knowledge, awareness, motivation, belief, attitudes, and social norms related to efficient resource consumption. Such approaches rely on the assumption that the improvements will positively affect individual’s resource conservation behaviours. In line with this, different studies have focused on applying informational approaches in order to promote conservational behaviours (Abrahamse et al., 2005). In some cases, informational strategies had limited effects on behavioural changes, while others attained greater achievements in the promotion of individual resource conservation behaviours. The informational approach includes different techniques, such as: informational prompts (Luyben, 1982), personalised social marketing with information tailored to individual needs (Abrahamse, 2007b) (Daamen et al., 2001) (Thogersen, 2007); consumption commitment (Katzev and Johnson, 1983, Katzev and Johnson, 1984) (Bamberg, 2002) (Jakobsson et al., 2002); and, modelling linking comparable consumption behaviours (Schultz et al., 2007, Abrahamse et al., 2005).

An additional study conducted by Brandon and Lewis (1999) pointed out that accumulative information provided to individuals about resource consumption had a major positive impact on individual behaviours and conservational actions. However, according to the results of previous studies (Baek and Lee, 1987), different factors were identified as important in influencing individual resource conservation behaviours. A better individual awareness and positive attitude will lead to more resource conservation behaviours (Baek and Lee, 1987) and improvements in individual awareness regards resource conservation will lead to improvements in resource conservation behaviours (R.B. Peyton, 1980, Choi, 1990).

In the context of this study, based on literature findings, up to present time, individuals hindered from the absence of comprehensive utility management platform that provide a services of efficient utility management and provide integrative information and services that can contribute in raising individuals' awareness to sustainability issues. Providing unified information about utility resource usage and conservation might have an impact on individual environmental behaviours. The literature review, shows that pro-environmental attributes of individuals such as: attitude, awareness and their interest in resource conservation is a major variables that can have impact on their overall pro-environmental sustainability behaviours and resource conservation activities (Baek and Lee, 1987).

2.4.3 Role of technology in promote individual pro-environmental sustainability

The human impact on the environment can be viewed as a factor made up of people, their activities, and the information technology that they are using (Ehrlich and Ehrlich, 1991). The increased number of Internet users (ITU, 2010), the lower cost of Internet access (ITU, 2010) and the increase in smart device usage (Pitt et al., 2011) have contributed to the facilitation of accessible resource consumption information by agencies and individuals (Boudreau et al., 2008). Furthermore, the latest improvements in technologies may offer other new and improved means of accessing information, such as real-time feedback and the ability to analyse resource consumption. These rapid technological advancements are attractive for individuals, services provider's agencies, service regulators as well as other utilities parties.

As can be observed from the literature, different information technologies have been developed to present an instant feedback of individual's sustainable behaviours, which can be accessed online via their mobile devices. For example, Froehlich (2009) introduced a mobile information technology system for monitoring tools that promote sustainable transportation behaviour. In addition, Bjorkskog (2010) designed a technological innovation using wireless technology to enable real-time feedback of individual energy consumption. Likewise, Holmes (2007) introduced a technology innovation that combined art and technology to reduce energy consumption and displays energy consumption information.

Recently, information technology in utility management services has been advanced by the production and distribution of smart devices that provide digital and attractive services beneficial to all utility parties. The use of a smart metering infrastructure in different countries offers additional information technology improvements (Renner et al., 2011). For example, the EU have planned for 80% of all customers to have smart meters installed in their dwellings by 2020 (Renner et al., 2011). This technology enables detailed and real-time information about resource consumption at home to be obtained. It can offer individual and utility organisations a more advanced interaction with accurate/real-time information about resource consumption.

It is necessary to differentiate between the different roles of technology and explain the relationship between information technology and individual sustainability behaviours. Information technology can be categorised into a number of roles: (1) an intermediary, in which technology is developed for achieving the goals of determining the environmental impact; (2) an amplifier, where technology plays a role of amplifying an individual's capacity to achieve their goals as well as their ability to use resources; (3) a determinant, where the use of technology features form or empower individual behaviours; and/or, (4) a promoter, where the technology is specifically created to impact on individual behaviours (Midden et al., 2007).

With the above in mind, it would be beneficial to evaluate different technology roles as a basis to designing an information technology platform and outlining sustainability interventions techniques that can contribute to the improvement of individual sustainability behaviours. In this study, technology innovation aims to prompt individual behaviours towards environmental sustainability. Thus, the role of the technology in the context of this research can be seen as that of 'promoter', where the technological innovation with its different features can assist in improving individual sustainability behaviours.

Another study has defined three different roles of technology innovation (Fogg, 2003). These roles include the idea of a technology as persuasive, social actors and/or as media. In some situations technology innovations can be seen as a combination of one or more of those roles.

The first role of technology as ‘persuasive’ makes reference to the use of information technology as convincing users to change their attitudes or behaviour (Fogg, 2003). It can motivate the users to perform particular activities by making their tasks easier, and more efficient and achievable. This role was developed for many purposes in different areas of commerce (Boyland et al., 2012), including: health (Lin and Mann, 2012, Klasnja and Pratt, 2012), education (Cismas, 2011, Rosmani and Wahab, 2011), tourism (Steckenreuter and Wolf, 2013, Koutra and Diaz, 2013), and environmental sustainability and natural resource conservation (Meineri and Guéguen, 2012, Van de Velde et al., 2010) (Willis et al., 2010, Chen et al., 2012).

In previous research, several techniques have been applied to encourage natural resource conservation including using technology to promote efficient resource usage and encourage individuals to use renewable energy solutions (Abrahamse et al., 2005). However, in the present situation, individuals seeking feedback about their resource consumption usually obtain the information via bills rather than real-time information services. Such real-time services (if indeed they currently exist) can contribute to user behavioural change regards a more efficient resource consumption, as a result of increasing their awareness of the link between their behavioural activities and natural resource consumption (Abrahamse et al., 2005). In order to effectively influence individual behaviour, the feedback information needs to be clearly comprehensive with less effort required on behalf of users in order to analyse and interpret the data (Chiang et al., 2012).

Ambient persuasive technology is an additional type of technology that has yielded interest from researchers seeking to encourage sustainable lifestyles for individuals by means of information technology. A study conducted by Davis (2008a, 2009) identified the design determinants of ambient persuasive technology for influencing environmentally sustainable behaviour (Davis, 2008a, Davis, 2009). It was advised that the preferred design for persuasive technologies targeting environmental behaviour change is a technology capable of “[making] suggestions at exactly the right time and place, without annoying those to be persuaded.” (Davis, 2008a).

The purpose of ambient persuasive technology implementation is to positively impact individual behaviours and attitudes towards environmental sustainability (Fogg, 2003). In line with this goal, and since the technology has the capacity to provide tailored feedback information related to individuals' resource consumption and behaviours, it is necessary to be capable of persuading individuals to lower their resource consumption and to embrace more sustainable behaviours.

The available literature indicates that several ambient technologies have been introduced that aim to promote an individuals' awareness regarding resource consumption and influence their environmental behaviours (Wattson, 2013) (Martinez and Geltz, 2005). Previous studies have focused on the continued positive impact on individual sustainable behaviours (Midden et al., 2008, Pousman and Stasko, 2006, He et al., 2010, DiSalvo et al., 2010, Froehlich et al., 2010, Chisik, 2011). Another study (Froehlich et al., 2010) specified unobserved natural resource consumption and highlighted the potential positive impact of feedback information on changing individual consumption behaviours, presenting four design patterns for ambient persuasive technologies. Elsewhere, He et al. (2010) introduced a transactional theoretical model as a design framework for resource consumption feedback technology. It shows that different individuals have different levels of readiness, willingness and ability to change their behaviour. Thus, technology innovation design should consider that each individual is motivated to change behaviour by different methods.

As a conclusion of earlier studies on different technology innovations and electronic devices with specific goals, it is indicated that they might have an influence on an individual's environmental behaviours, This might lead to a greater influence on individual behaviour and efficient natural resource consumption, but technological approaches and techniques were not yet smart enough in most cases to make those goals achievable efficiently. At the present time, the technology paradigm represents an opportunity to provide a comprehensive and user-centric intelligent information technology platform that will be capable of encouraging individual's to change their sustainability behaviours. The majority of earlier research has focused on providing consumption feedback to influence individual resource consumption (Van Dam et al., 2010, McCalley and Midden, 2002, Holmes, 2007, Chen et al., 2014). These studies have usually applied simple feedback on resource consumption, while some used basic display technologies. It is obvious that there is a need for an integrated technology innovation platform that includes all parties to sustainable activities, which is designed specifically to influence individual behaviours. Such a technology innovation platform is essential to achieving the desirable goal of better individual sustainable behaviours. It can also play a leading role in the provision of a unified shared environment that is geared to user needs, as well as to sustainability stakeholders and to the achievement of the ultimate goal of promoting individual behaviours towards sustainability.

2.4.4 Role of technology in individual behaviour change

It is widely recognized, that natural resource conservation by individuals has become an interesting area of research for both social and environmental scholars (Abrahamse et al., 2005). The interaction between technology and individuals has had a considerable role in resource conservation and individual behaviour (Yao and Zheng, 2010). The study by Doukas et al. (2007) asserts the need for dealing with the requirements of building an efficient utility management resource and for the provision of support to the individual to enable the achievement of efficient resource consumption. According to Yao and Zheng (2010), the greatest difficulties facing efficient utilities resource management are the inconsistency and absence of real-time feedback information about resource consumption. (Yao and Zheng, 2010) Individuals have limited information about previous behaviour and the amount of resources consumed. In most situations they know their resource consumption from their billing information but real time feedback services are absent. Different studies suggest that installing real-time feedback to increase an individual awareness regards resource conservation has a major impact on decreasing resource consumption, by 4 to 12% (Ehrhardt-Martinez et al., 2010). By implementing real-time feedback, the individual will be more knowledgeable about the effects of their behaviour on utilities resource conservation (Abrahamse et al., 2005).

The latest technological developments in the utilities industry, such as smart meters, can provide users real-time feedback information about their utilities resource consumption (Shah et al., 2009). Thus, as a result of improvements in technology in this area, researchers in environmental sustainability and individual behaviour change have designed several innovative technologies with different capabilities linking individual behaviour with their resource consumption using feedback information features (Benders et al., 2006).

In previous studies, different feedback information mechanisms were used. Some studies link the change in individual behaviour with the resultant outcome influence on resource conservation, while others provide recommendations targeting individual behaviour change (Abrahamse, 2007b). The overall effects of technology and awareness interventions have had an important impact on convincing users to change their behaviour and save on resource consumption (Steg, 2008). Using technology as a real-time monitoring tool to provide real-time information about resource consumption has also had positive effects in resource conservation, while feedback information can be enhanced with advanced interactive technology that is designed specifically to change individual behaviour and attitudes (Abrahamse et al., 2007). This kind of interactive technology innovation has the ability to influence individual behaviour and to encourage individuals to change their attitude and behaviour towards sustainability by different means such as: modelling, providing social supports or rewards (Fogg, 2003).

As found in previous research, the main aim of technology innovation development for environmental sustainability is for the technology employed to motivate and support individual sustainable behaviour (Völlink and Meertens, 2006). It was applied in different areas including: raising individual knowledge awareness, providing analytical services for different behaviour and consumption patterns, as well as providing information feedback about consumption (Dixon et al., 2014). However, designing inappropriate information technology strategies targeting resource conservation usually leads to unsatisfactory results regarding the promotion of individual sustainability behaviours (Midden et al., 2007), and also has an impact on user resistance to technology utilisation and to their evaluation of technology benefits compared to their previous expectations of technology outcomes. In some previous studies (Darby, 2006), a limited achievement was observed in the role of technology in effecting individual behaviours towards sustainability, which is due to their focus on individual intentions only, with less consideration given to the technological context in which such sustainable behaviour intervention techniques were happening.

However, improvements in recent technological features have made it easy to develop effective technological innovations with effective capabilities that are user friendly, which can play the role of meeting utility users' expectation and facilitating pro-environmental behaviours. It can also, facilitate the development of real-time shared feedback as a more effective means of communication rather than general feedback information. By referring to relevant studies that aim at promoting sustainable behaviour on an individual level (Völlink and Meertens, 2006), almost all technological innovation approaches had a tendency to employ a one-way interaction with individuals, whereas recent technological capabilities offer two-way interaction with all different parties, including the individual. The future innovation in technology for promoting individual behaviour regards sustainability needs to be a more comprehensive shared environment with a more adaptive capacity enabling two-way interactive technology, which in turn allows for instant, accurate, and real-time functionalities with more user-centric and personalized information services.

2.5. Summary

This chapter has outlined the part (I) of the literature review related to the research topic. It was provides foundation information related to the area of eServices delivery approaches and its fundamentals concepts, emerging revolution paradigms as well as background information on the 'one-stop' services delivery paradigm in similar field of research. In addition, it literature review several aspects related technology role for individual sustainable behaviour encouragement. Lastly, the literature review findings will be used to underpin the suggested platform with number technological strategies that will contribute in promoting individual pro-environmental sustainability. In next chapter, will present, part (II) of the literature review, to provide necessary information that will be employed for underpinning the development of the conceptual model used in this research.

Chapter 3: Litrature Review – part II;

The research conceptual model, Development of theoretical framework of user perception towards the creation of the platform (perceived technology-fit and benefit), technology acceptance, and potential effects on individual sustainable behaviour.

3.1. Introduction

The purpose of this chapter is to build on the literature review to present an in-depth discussion about the development of the conceptual model used in this research. Based on the literature, three aspects of focus were determined, namely (a) user-centric service delivery approach, (b) integrated virtual enterprise environment, and (c) the technology characteristics in promoting individual sustainability behaviour. These aspects have informed the development of the ‘integrated virtual enterprise utility management’ model and associated eService delivery approach (i.e. the one stop' model). Furthermore, the different subjects of interest were formulated in the theoretical framework at different stages. Initially, user perceptions towards the new research model were identified in order to investigate the appropriateness of such a new conceptual framework and associated eService delivery approach with user task needs. An evaluation of users’ intentions to adopt the conceptual technology innovation model in a utility management context followed. The final aspect was directed at an exploration of the potential effects of e-sustainability related functionality (which was integrated into the conceptual model) on the promotion of sustainable behaviours from the utility users’ perspective.

Several other theories were reviewed, such as user task-technology-fit (TTF) (Goodhue, 1995), technology acceptance and diffusion of innovation adoption, as well as theories of individual behavioural intentions. The literature review has informed various aspects of the research, including user perception, attitude, and behavioural intentions at a precursory stage of technology innovation utilisation. Moreover, the chapter elaborates on user perspectives towards the research model in terms of reviewed dimensions of technology fit with user task needs (TTF), perceived characteristics of innovation (PCI) (Moore and Benbasat, 1991), potential benefits, intentions of technology use, and the behavioural effects associated with the sustainability related functionality integrated in the research model.

This chapter is divided into four main sections. The first section describes the main focus of the research, highlighting the various components of the proposed conceptual research model. The second section provides a detailed formulation of the theoretical research framework that was adopted to validate the proposed conceptual research model. The literature review is motivated by the need to examine different user perspectives as to the innovative model proposed in this research. This includes theories studying the effects on intentions to engage in pro-environmental behaviours at an individual level.

The TTF (Goodhue, 1995), technology acceptance model (TAM) Davis (1985), diffusion of adoption theories (DOI), PCI (Moore and Benbasat, 1991) and theory of planned behaviour (TPB) (Ajzen, 1985), presented previously in the literature and related empirical studies will be used in this theoretical framework to evaluate the conceptual model from different perspectives, such as: TTF, user technology acceptance, and the model expected to influence user behavioural intention towards sustainability.

Along with the theoretical formulations presented in this chapter, research hypotheses were formulated, as well as a detailed measurement of proposed research constructs, providing a theoretical framework for investigating the user perception of TTF (including perceived fit and net-benefits), technology adoption, and the effect on user behaviour intention. All of the variables will be incorporated into the theoretical validation of the conceptual model used in this study. The final section provides a detailed summary of the theoretical research model components, including the associated hypotheses, and concludes with a list of the hypotheses proposed by the final model to be tested for the purposes of this research.

3.2. The research conceptual model

Information technology success is user perspective dependent. DeLone and McLean (1992) suggest that technology innovation characteristics affect user perceptions as regards to satisfaction with technology. This assumption is supported by other related studies that found technology innovation satisfaction success is determined by the concordant meeting of users' expectations of the technology innovation characteristics. Where they are not met, the technology tends to be rejected by the users (McKinney and Yoon, 2002, Yu et al., 2004).

As observed from the literature review, prior research has focused on the key aspects of innovation technology service adoption from user perspectives. In previous studies conducted by Barua et al. (2001, 1995) it was concluded that organizations aiming to provide online services should consider initiating a proper strategic plan before implementing any technological solutions. Such a plan is considered as an essential step forward in successful technology innovation adoption (Agarwal and Tanniru, 1992). The technology innovation strategic plan of successful e-agencies should include the identification of new technology innovation opportunities, the limitation and deficiency of exciting technology, areas of improvement for the strategic plan, an evaluation of the feasibility of investment in technology innovation, and the assessment of user capability to deal with such technology (Ward and Peppard, 2007, Ward and Peppard, 2002).

These dimensions of strategy represent the need for a technology innovation adoption framework, which is considered as a fundamental part of any overall strategy for successful technology innovation implementation within organisations. It also provides a tool to assist agencies in a greater understanding, and thus enhanced evaluation process, of the limitation and deficiency of their innovation, facilitated by the assessment of user perspectives as regards to the adoption of innovation. In order to increase the benefits and mitigate the potential risks of implementing online services delivery solutions, agencies must not be limited by the evaluation of the perceived value and technological attributes of solutions but should also carefully measure the level of user TTF, technology acceptance and adoption of technology innovation (Hartman et al., 2000) (Basole, 2005).

By reviewing, consolidating and analysing the literature available on recent technology service paradigms, as well as the associated recent service delivery approaches and their influence on user adoption of innovation, this study has identified a number of key aspects of the conceptual model considered as factors that potentially influence the user perspectives as regards to the benefits of initiations, such as the ‘integrated virtual enterprise utility management’ model and the associated eService delivery approach (or 'one stop' model) that provides utility users with an efficient solution to managing their utility services effectively over the Internet. The resulting focuses of the research model are defined as: user task–technology fit, user technology acceptance, and technology influence at an individual level as regards sustainable behaviours. The components of the conceptual model to achieve the research outcomes defined in Chapter 1 (Figure 1-1), are a synthesis of three aspects, as shown in Figure 3-1:

a) User perceived benefits of the initiation of the research model and task-technology fit with their needs regarding utility management activities (also defined as user perceived technology-Fit and net-benefits perspectives);
b) User technology acceptance of the innovation in the conceptualised research model (or user technology acceptance perspectives); and,
c) The potential influence of the conceptualised research model including innovation attributes with its associated sustainability-related functions (which are integrated within the research model) on user behaviour intentions as regards to pro-environmental sustainability (i.e. the promotion of sustainable individual behavioural perspectives).

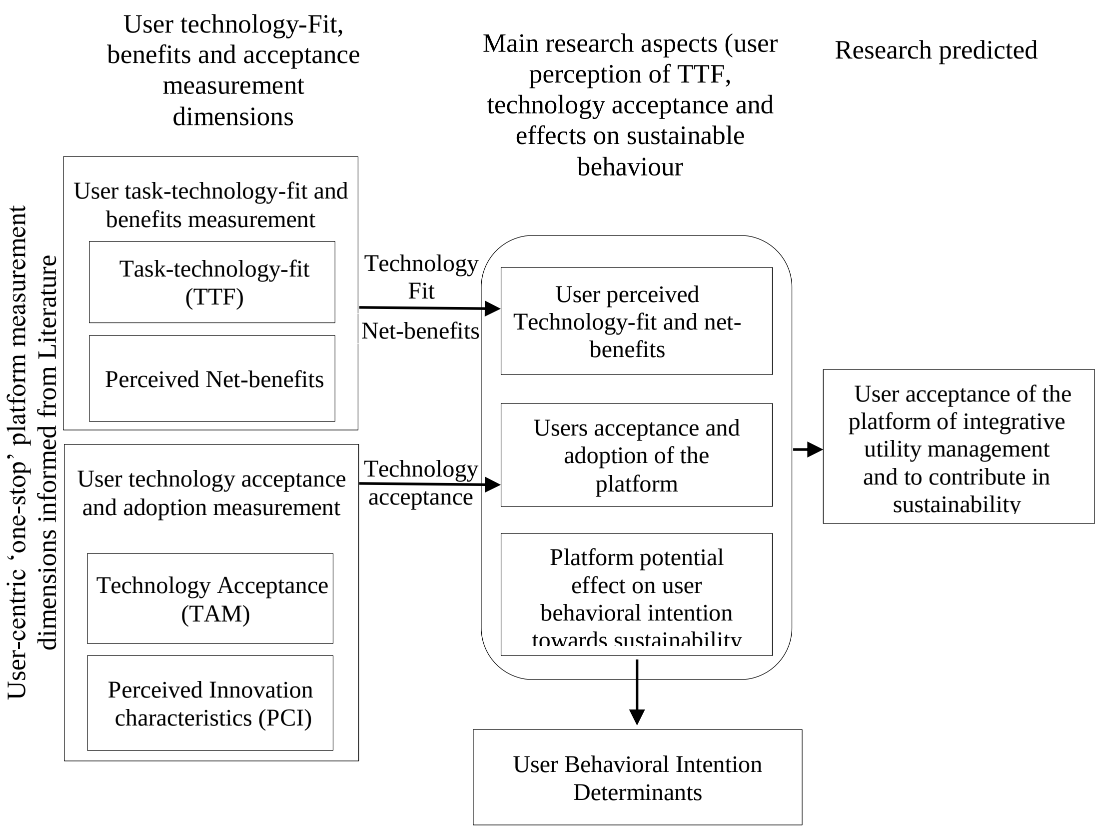

Figure 3-1: Three main aspects to achieve the research outcomes

In order to answer the research questions, three components were determined, as depicted in figure 3-1. The detailed description of the conceptual model can be highlighted as follows. On the left hand side, different aspects of technology innovation that affect user perspectives of the model's expected benefits and technology adoption were identified including two component dimensions of measurement (user's perceived 'technology-fit' and 'technology acceptance'). One model component was devoted to the user evaluation of the overall expected influence of the model on promoting intentions regards sustainable behavioural change.

In the middle of the conceptual model are the three dimensions of assessment in relation to users' adoption of innovations in technology, which can be considered as the major components affecting the stages of model adoption success from a user perspective. As other scholars have asserted, a user's evaluation of task-technology fit from their perspective is deemed to be a precursor of user intentions to use such an innovation.
On the right hand side, the outcome of intention to use the 'integrated virtual enterprise utility management' platform (or 'one stop' model) is illustrated. The assumption is that a stronger intention to use a technology innovation model (with its associated eService's delivery approach) will make users more likely to actually use the innovation ((Dabholkar and Bagozzi, 2002); (Shih and Fang, 2004);(Lai and Li, 2005);(Cheng et al., 2006)). In typical situation, the future actual usage of the research technology innovation model is identified as a consequence of the users' intentions to use such technology. Most of the prior literature has found that users' intentions reliably predict their actual behaviour (Fishbein and Ajzen, 1975);(Sheppard et al., 1988);(Ajzen, 1991). Furthermore, much research on information systems has used "intentions to use" variables in order to predict users' "actual use" behaviour in the context of information systems ((Thompson et al., 1991) and (Venkatesh et al., 2003). In line with these previous studies, the current research measures user intentions to use the 'integrated virtual enterprise utility management' model and the intelligent eService delivery approach (or 'one stop' model) in a utility management context to predict users' actual technology use and associated behaviour. In accordance with this tradition, all factors effecting user intentions to adopt the technology innovation are integrated into the model, as shown in Figure 3-1. The arrows shown in Figure 3-1 symbolise the proposed causal relationships between the conceptual model components.

Having introduced the conceptual research model, the following sections discuss the dimensions of the theoretical research framework for validating the research conceptual model with a more detailed description of the instruments of measurement and a formulation of the research hypotheses.

3.3. Development of the theoretical research framework and hypothesis: The literature underpinning components of the research model

Recent studies on the revolution of the information technology and the eService delivery paradigm have shared the common goal of utilising high-technology features in order to increase the fit of the technology with user needs, and facilitating technology innovation adoption as regards to electronic services on the Internet. In some of these studies, information technology was viewed as a persuasive instrument to promote user awareness and affect their behaviours. In such a situation, users' acceptance of the technology is essential. However, in order to measure the user perspectives on the technology innovation framework developed in this study, different aspects of technology-fit, acceptance of innovation, and the influence of the technology on user behavioural intentions have been investigated. In the examination of the innovation attributes and potential influence of the technological framework developed in this study as a means of user interaction among utility parties, it is important to highlight the key variables outlined in related theories by making reference to previous studies conducted in the field of technology acceptance in general as well as task-technology fit, electronic services adoption and behavioural theories. In this section, an appropriate theory was selected for the purpose of validating the study conceptual model from the perspectives of end user task-technology need, technology acceptance, innovation adoption, and the potential of the technology to positively influence their intentions to adopt sustainable behaviours. The investigation focuses on users' willingness to use the research proposed platform with the goal of enhancing sustainability awareness and individual behaviour in this respect. It will be validated with the aid of previous theories provided in the literature and empirical research conducted in similar fields of study.

The relevant theories and empirical studies on TTF, user eService adoption and individual suitable behaviour have been critically discussed in the previous chapter in order to provide a basic understanding that is necessary for the further development of the hypotheses of this study. This section aims to establish the foundation for formulating the theoretical framework of the 'integrated virtual enterprise utility management' model, that will be used to explain the different aspects of user perspectives to technology innovation in a utility management context, including the following analytical components: user task-technology fit, future user behaviour expected with technology acceptance, and the effects of technological dimensions of innovation on user's sustainable behaviours in the future.

The underpinning theoretical framework adopted the use of theory of task technology fit, TAM (Davis, 1989), DOI, and PCI measurement in order to build a theoretically composed validation model with specific constructs slected from those related theories. The detailed measurement constructs to be employed in the proposed models are derived from those theories namely: TTF; technological characteristics, TTF; task characteristics, TTF; individual characteristics, TAM; perceived ease of use, TAM; perceived usefulness, DOI; perceived innovation characteristics and user intention towards using the innovation. These key influencing variables were hypothesised so that they can provide a basic framework to investigate the utility user's intention to adopt the innovative model (an 'integrated virtual enterprise utility management' model and intelligent eService's delivery approach (or 'one stop' model)) that facilitates their utility management and provides an efficient means to improve user sustainability behaviours. In this direction, one of the most effective approaches that considered these perspectives (influencing individual behaviour towards sustainability) were employed in this study in order to investigate the model's potential effects on pro-environmental user behavioural intentions.

Figure 3-2 illustrates the use of both models in three different phases of validation. Constructs were then further decomposed for the purpose of this research. New constructs pertinent to the user technology acceptance of eService in a virtual enterprise environment have been included as well as constructs relating to the user satisfaction or perceived net-benefit of adopting the integrated virtual enterprise utility management model for utility management and its associated activities.

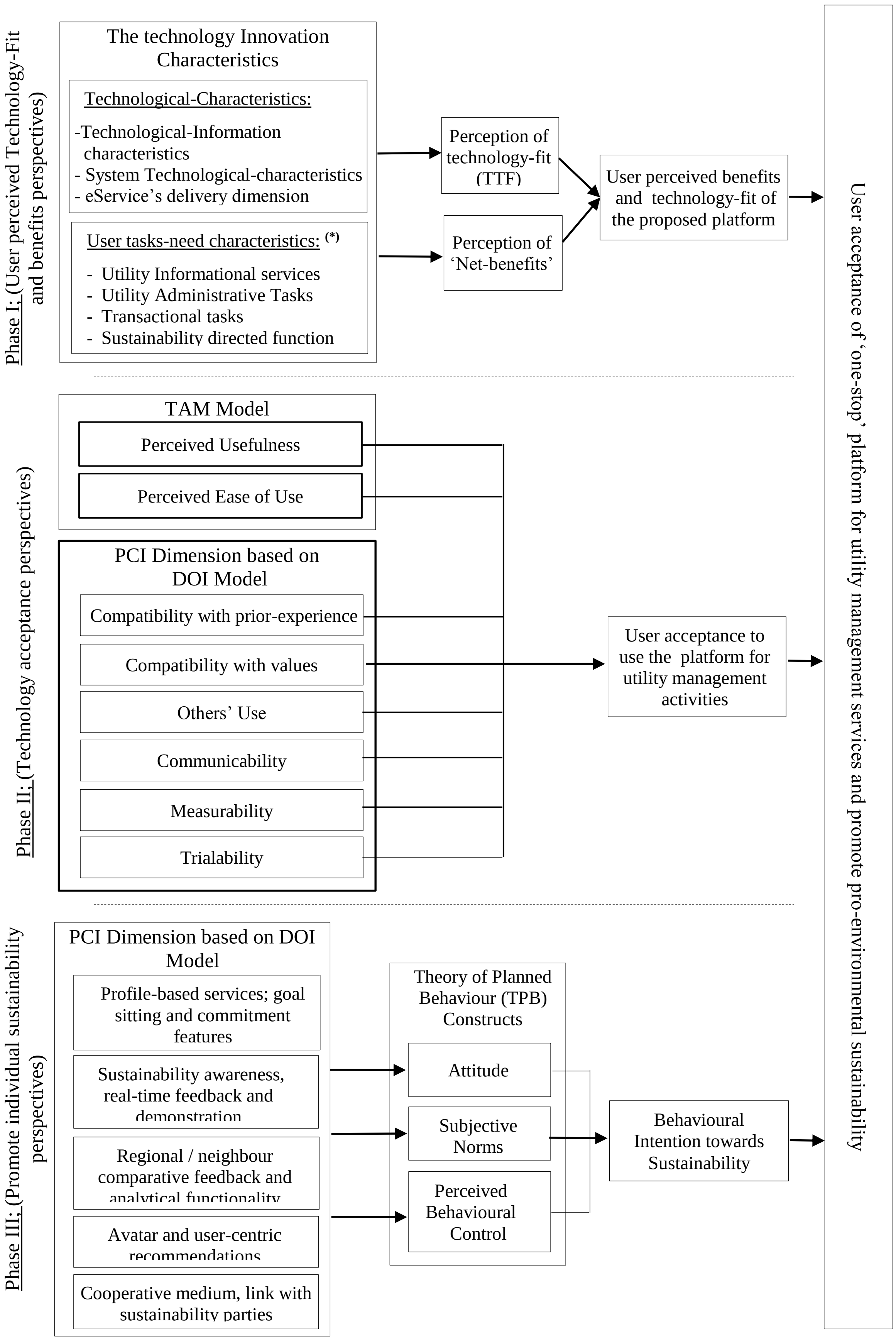

Figure 3-2: Three stage research model of user TTF, technology acceptance, and effects on individual intention to pro-environmental behaviour

(*) Detailed user tasks-characteristics is defined in section 3.3.1.1.2 (Table 3-2)

Given that the integrated virtual enterprise technology innovation and services delivery paradigm for utility management constitutes a new model, the necessity for an empirical evaluation taking into account similar studies in the field has been underlined by researchers. However, such an evaluation has not yet been carried out and the area remains a new domain. This study builds upon the existing work to provide a deeper and more theoretically driven investigation. To the best of knowledge of the author, there is no similar framework or even empirical investigation of an 'integrated virtual enterprise' technology platform (or 'one stop' model) in a utility management context and the theoretical framework outlining how such a study would be conducted is still non-existent. This research is posed to overcome these challenges and fill the gaps of knowledge by means of formulating the conceptual model and undertaking an empirical exploration of the user perspectives to the initiation of an 'integrated virtual enterprise' technology innovation by using appropriate theories of TTF, TAM, DOI, and PCI theory. During the initial phase of investigating user perspectives, this study will use the TTF theoretical framework (Goodhue, 1995), which has been used to evaluate user perspectives on technologies fit for various types of tasks. Earlier studies on TTF provide support for the assertion that the value of a technology greatly depends upon the technology capacity to comply with user-tasks needs that user is trying to accomplish. This study develops a theoretical framework to evaluate the user perception of "technology fit" when trying to accomplish their utility management tasks by using the technology innovation. It is hypothesized that for utility user tasks that might involve integration of services and information from multiple sources, the fit is higher when the proposed technology innovation is initiated with some technological attributes suitable for specific characteristics of user task needs. Thus, the technology innovation model provides overall value from a user perspective.

The following sections describe the detailed theoretical framework that was applied in this study. The stages of development of the theoretical framework are depicted in Figure 3-2, highlighting the main research phases sequentially. The research phases are divided into three main parts. The first part (phase I) presents the theoretical framework that will be used to explore user's perception of both task-technology fit and net benefit of the new concept of an 'integrated virtual enterprise utility management' model developed in this study. This will help to provide a focus on the importance of including user perceptions of task-technology fit as a major factor affecting the user perspective of the supposed value of using the technology. It is also an essential preliminary step to be undertaken before predicting the user intention to accept the new technology innovation in the context of this research model. The theory of task-technology fit presented in similar literature and some empirical studies related to the subject of the study will be evaluated to provide an investigation into user perceptions toward the innovation. This will be evaluated with the proposed theoretical framework, as depicted in Figure 3-2. In summary, Phase I outlines the user tasks technology-fit and net-benefits perspectives.

In the second part of this section (phase II), the user intention to accept use of the ‘integrated virtual enterprise utility management’ model and associated eService’s delivery approach (or 'one stop' model) will be evaluated. Different relevant theories of technology acceptance and diffusion of innovation adoption will be incorporated with a view to presenting the theoretical model of validating the user intention towards the proposed model.

The last part (phase III) aims to evaluate the potential influence of the proposed innovation framework on user awareness and intentions toward environmentally sustainable behaviours and to predict its effect on their future willingness to use this innovation as an enabling technology that encourages sustainable behaviour.

3.3.1 Phase I: User perspectives on the initiation of an integrated virtual enterprise utility management Model

As has been indicated in relevant literature, the impact of user perceptions of the value of technology innovation on the overall estimation of user satisfaction is being investigated in the context of a different business interaction model. Specifically, in the area of both business-to-business and business-to-customer interaction domains (McDougall and Levesque, 2000, Eggert and Ulaga, 2002, Spiteri and Dion, 2004), (Petrick, 2002, Sirdeshmukh et al., 2002). Furthermore, another study by (Parasuraman and Grewal, 2000) suggests the importance of examining the value of electronic services in the broad domain of technology and then to the business-to-customer domain specifically considering user value perceptions is domain-specific (Faroughian, 2009). In this direction, some related efforts with important findings were conducted by researchers in this domain (Han and Han, 2001, Mathwick et al., 2001, Kim, 2002, Chen and Dubinsky, 2003, Kleijnen et al., 2007). However, despite the available research efforts relevant to the delivery of value-added user technology services in the e-society domain (i.e. e-government, e-business, e-commerce, e-shopping etc.), to the best of the author’s knowledge, no previous study has focused on delivering user-centric innovative technology services specifically for utility management in a virtual enterprise environment, nor does exist research that links innovative technological characteristics with users' perceptions of electronic services benefits. In addition, with regards to technology innovation in service delivery strategies, a wide range of previous research has mainly focused on electronic services supply-side perspectives (Helbig et al., 2009, Christopher G, 2005, Reddick, 2006) and consequently user needs or perceived values have not been adequately accounted for (Streib and Navarro, 2006). A recent study that reviewed progress in the electronic service delivery field consistently called for more research into the study of the demand for electronic services from a user perspective (Helbig et al., 2009, Christopher G, 2005). The common emphasis of these aforementioned studies is a supply-side perspective that tends to benchmark the existence of services without considering the underlying dynamics of actual usage. Those studies that exclude user perception tend to have a narrow view of electronic services benefits, and fail to display a comprehensive account of electronic service delivery success. Due to the increased deployment of technology innovations, there are further challenges of exploring the user perceived benefits and impacts of this new form of technology.

One of the primary goals of this research is the evaluation of user perceptions towards the initiation of an 'integrated virtual enterprise utility management' platform (or 'one stop' model) and the capabilities of the associated eService delivery approach. An appropriate information systems service delivery strategies in similar area of business-to-customer domain was reviewed to identify situations in which a more advanced online services delivery approach (beyond the basic online services delivery approaches that are commonly employed) may be helpful. As part of online user tasks of managing their services activities online, the users often explore technology innovation capabilities and the alternative options that can be used for accomplishing a specific task, along with the benefits that can be obtained (Legris et al., 2003).

According to the findings of previous studies, technology innovation use is contributed to by a combination of task, technological and organisational factors (Desouza, 2003). There is increasing interest in highlighting the importance of matching technology innovation with the portfolio of task activities that need to be performed, since it is recognized as an important antecedent determinant of technology usage and perceptions of user benefits (Kankanhalli et al., 2005b, Kankanhalli et al., 2005a). Taking these perspectives into account, the TTF theory was considered the most dominant and relevant theoretical framework applied in information system for investigating the technology fit perspective (Lee et al., 2007, Sorgenfrei et al., 2014). Goodhue and Thompson (1995) suggested that technology usage is administered by the match between technology features and the requirements of the task. Normally, the potential users will prefer the technology innovation and services that fit with their task needs requiring less effort and yielding maximum benefit.

The main goal of our study was to evaluate user perceptions across all the core components of the conceptual model of the 'integrated virtual enterprise utility management' model from TTF to net benefits expectation with a particular emphasis on the role of TTF on user perceptions of technology innovation benefits (Figure 3-3). The argument of this study was that if individuals choose whether or not to use information technology based on the perceived benefits of the technology for the task, then their use of technology innovation should be influenced by the innovation's characteristics. A fundamental argument of our model is that innovations in technology will be used if the functions available to the user support the task activities of the user.

A function of the integrated virtual enterprise utility management model supports an activity if it facilitates that activity. Normally, the users will prefer to deal with a technology innovation that facilitates them to perform their task activities efficiently and with more perceived net benefit. It is well recognized that technology innovation with less perceived benefits will be deserted.

(A user 'technology fit' and value perspective as a dependent variable)

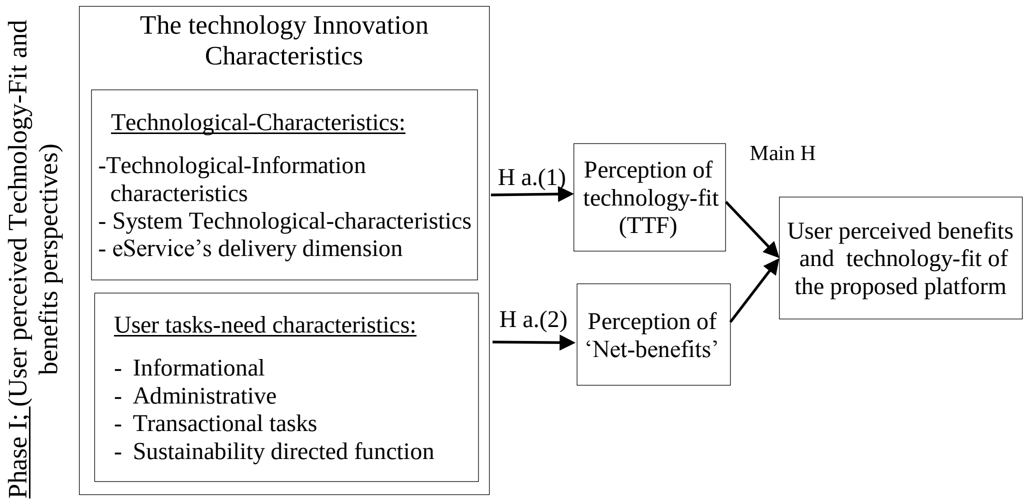

Figure 3-3: User evaluation of TTF and the perceived value of a 'one stop' technology innovation platform as an antecedent to technology adoption in the context of utility management

As depicted in Figure 3-3, the theoretical framework of validation to investigate the users' perception to the initiation of a research technology innovation model is formulated. It is a modified model of TTF measurement that is to be tested in this study. The proposed model is based on the important assumptions that the user perception of both TTF and 'net benefits' of an integrated virtual enterprise utility management' innovation in terms of user task needs will have an effect on the utility user perspectives towards the adoption of the technological innovation. Specifically, in research phase I, this study aims to test the following formulated hypothesis:

<u>Main H.a:</u> The creation of an 'integrated virtual enterprise utility management' model, reflected in a 'one-stop' platform, have positive affect on users' engagement with utility services, as well as their overall perception, with a focus on 'technology-fit' and 'net-benefits'.

The first theoretical validation model focus of this research Figure 3-3 (a) provides an investigation into the user perceptions of the match between the technology of a 'virtual enterprise utility management' model and the associated eService delivery approach with the user's task needs of managing their utility services online. The capability of technology in enabling the users to perform task activities is defined formally as a "fit" construct. It is the function of providing a match between task needs and innovation technology capabilities. Relevant to previous studies, the fit has a link with the evaluation of cost-benefit characteristics of any innovative technology that can provide a required support to complete the portfolios of the user's tasks. The TTF was successfully applied in the area of assisting technology innovation fit with tasks needs in different domains. The TTF theory highlights the conclusion that a greater value of technology innovation is the most capable of supporting users in completing their specific tasks efficiently (Goodhue, 1995). For that purpose, the TTF theory is used as the theoretical basis of this study in order to evaluate the technological fit of the research model as well as the impact of the fit (between utility user tasks and the technology) on user perceptions to the initiation of an 'integrated virtual enterprise utility management' technological innovation. According to previous studies, the technology fit approach can be described as a matching between perceived technology capabilities, task characteristics and the user's ability to undertake needs of a given task via the technology (Marcolin et al., 2000). For such goals, Goodhue and Thompson (1995) defined the TTF model, that links the innovative technology usage with antecedent user perceptions of fit between the technology's capabilities and the support it provides to the tasks that the user is trying to accomplish.

Accordingly, within the domain of information technology usage and services satisfaction, the user's perceived value of technology innovations will positively influence the users' behavioural patterns of interaction and technology innovation usage (Igbaria and Tan, 1997, Qian and Bock, 2005, Wu and Wang, 2006). As a result, the users' perception of the TTF of the innovation is considered to be an efficient predictor and precursor to technology innovation usage. The TTF model was used in this research in order to support the assumption that the technology innovation fit will potentially influence users' perception of technology-fit, which may lead in turn to a positive user evaluation and indeed their overall satisfaction. Thus, the research sub-hypothesis of phase I in the research model of this study (the technology-fit part) can be formulated as:

> H.a (1): Utility users have a positive perception of the 'technology-fit' of the proposed 'integrated virtual enterprise utility management' model in line with their online utility services management needs.

This work is focused on the discovery and exploration of fit between the 'integrated virtual enterprise utility management' technology innovation characteristics and the utility user task needs. However, the TTF framework does not include discussion of "usage" because usage takes into account ongoing use and the TTF framework explains only the initial utility user perception towards task-technology fit with their demands of managing utility services online. The related Section 3.3.1.1 will highlight in detail the "fit" construct, which will provide a theoretical framework of validation for specifically examining the user perspectives of 'technology fit' of the initiation of the 'integrated virtual enterprise utility management' model and the associated eService delivery approach in a utility management context. Another area of focus of the theoretical validation model besides that of 'task-technology fit' is the users' perspective of the proposed model being potentially influenced by the user's perceived benefit or comfort with the technological innovation. These latter aspects were also considered important factors affecting user perception to the technology's acceptance.

Different researchers in the field of information systems have discussed the users' perception of technological innovation benefits. The 'net-benefits' measurement has been widely attributed by scholars as being influential in the domain and they are agreed on the presence of technology benefits at different stages of the information technology lifecycle (Delone, 2003, Petter et al., 2012). As a result, in 2003, the DeLone and McLean model was modified, usurping their previous model by taking into account the new construct of ‘net benefits’ in the evaluation of information system success. The new model containing the new measurement of ‘net benefits’ was specifically intended to measure the broader effects of technology innovation in different development stages and in relation to stakeholder’s perspectives.

DeLone, (2003) argued that the "net benefits" of information technology are important variables influencing technology innovation success which mainly resulted from technology innovation characteristics such as informational quality, system characteristics and services quality. However, on the same subject concerning perceptions of technology innovation benefits, Goodhue, (1995) propounded that TTF is also related to the cost benefit evaluation in user decision making and behaviour towards information technology. This theoretical model indicates that users evaluate the costs and benefits of information technology at a prior stage to their decision to use technology to perform tasks (David et al., 1989, Goodhue, 1995). Apart from TTF theory, which suggests that users can consider and select the innovative technology that fits their tasks needs, the user ‘net benefit’ approach has argued that the users have the decision to select a technology innovation that they perceive with a greater net benefit (Goodhue, 1995).

In this study, as aligned with wide practice in relevant studies, the DeLone and McLean model was motivational to the adoption of the measurement construct of user perception to the 'net benefits’ as a factor affecting technology innovation success and also having a positive influence on the user’ perceptions of the technology. In addition to its world-wide acceptance, the 'net benefit' measurement construct was considered as the most appropriate because it is instrumental in the measurement of technology innovation success based on user perceptions regards the expected net benefits outcomes. On this matter, we can conclude the relevant hypothesis as follows:

H.a (2): Utility users have a positive perception of the potential ‘net-benefit’ outcomes of creating the proposed ‘integrated virtual enterprise utility management’ model in line with their online utility services management needs.

In summary, based upon the above discussion, we realise that technological innovation characteristics and task-technology fit with regards to different user's abilities are important factors affecting a user's perspective towards technology innovation where rational users assist technology innovativeness according to its ability to support their activity needs to manage utility tasks effectively. In addition, a user's positive opinion regards the initiation of the 'integrated virtual enterprise utility management' model has been identified as most likely to be impacted by a user evaluation of technology-fit as well as net benefits of the initiation of the research model.

The subsequent sections will present a comprehensive discussion of the TTF framework measurements that have been proposed in Figure 3-3. This is followed by an explanation of the construct of user perceived 'net benefits' as another major factor affecting user perspectives to the initiation of the research model under study. A detailed presentation will follow, highlighting the various components of the theoretical validation framework (phase I) that includes both the user perceived technology-fit and expected 'net-benefits' outcomes that are of interest to this research.

3.3.1.1 User technology-fit perspective

As has been stated earlier, different research efforts attempt to present an understanding of factors preceding technology innovation acceptance and usage intentions. In accordance with this, a framework of TTF theory (Goodhue and Thompson, 1995, Goodhue, 1998) is defined in order to explain the fit between the technology's characteristics and tasks that users are trying to accomplish, and predict particular effects on the technology's usage. Previous studies in the field have typically applied the TTF theoretical framework in the exploration of a wide variety of technology innovations in areas, such as, knowledge management technology (McCarthy, 2002a), decision support (Zigurs et al., 1999, Murthy and Kerr, 2000, Shirani et al., 1999), maintenance systems (Dishaw and Strong, 1998a), and other technology applications (McCarthy, 2002b). Research in these areas can contribute to the more efficient development of technologies that are a better fit with user demands from technology innovation within the context of the organisations. It can also provide more information on potential opportunities and deficiencies to be considered in the planning of technology development strategies. The TTF framework, as defined by Goodhue and Thompson (1988, 1995) , has been widely applied in information system's research to provide a theoretical base framework for investigating user evaluations of technology innovation fit between technology characteristics and user tasks demand.

The main hypothesis of the task-technology framework is that, a user evaluation of technology value is perceived according to the technology's effective capacity in supporting their task portfolios, which will be inverted in their overall evaluation of the technology innovation. Thus, a more positive user evaluation of innovation 'TTF' will result from the matches between user task needs and technology support functionality.

According to the dynamic nature of change in user task demands and technology capabilities, a similar associated dynamic change is expected in the capability of the information technology to match the new situation. The better technology is the more capable of dynamic change to fit with user task needs. The TTF main framework constructs were normally used to evaluate the extent that technology innovation characteristics matches with user task needs and provide reflection on users' evaluations of the technology (Goodhue, 1995). This theoretical framework was applied to examine different hypotheses that relate prior to and after the user evaluation of technology innovation

As has been concluded from previous studies, the TTF is considered to be a prominent theoretical framework and thus is typically applied to predict and investigate the user evaluation and use of technology innovation in this research. The main original framework and measurement constructs of the TTF theory are illustrated below, before the focus is narrowed to the research model that will be used in this study. It includes the following constructs:

- *Technological characteristics*: "Technologies are viewed as tools used by individuals in carrying out their tasks. In the context of information systems research, technology refers to computer systems (hardware, software, and data) and user support services (training, help lines, etc.) provided to assist users in their tasks" (Goodhue and Thompson, 1995).
- *Task-characteristics*: "Tasks are broadly defined as the actions carried out by individuals in turning inputs into outputs. Task characteristics of interest include those that might move a user to rely more heavily on certain aspects of the information technology" (Goodhue and Thompson, 1995).

- *Individual's characteristics*: refers to the characteristics of the individual such as "training, computer experience, motivation… that could affect how easily and well he or she will utilize the technology." (Goodhue and Thompson, 1995)
- *TTF*: is defined as "the degree of which a technology assists an individual in performing his or her portfolio of tasks. More specifically, TTF is the correspondence between task requirements, individual abilities, and the functionality of the technology." (Goodhue and Thompson, 1995)

This research examines TTF as a precursor to an individuals' innovation usage. It intends to present the feasibility of assessing the effectiveness of task-technology fit from end user perspectives regards tasks they are trying to accomplish in a utility management context. To the best knowledge of the author, presently there is no empirical research available explaining the utility user task technology fit and the expected impact of their technology innovation adoption. Certainly, there is an important demand for such research to determine how electronic utility services are currently perceived by most individuals today and precisely what task needs and technological variables are impacting their intentions to use such services. It is of prime importance for current researchers in the field to begin evaluating a number of these matters from the perspective of utility users based on the theoretical framework of task-technology fit theory. For this reason, the existing study employs task-technology fit theory to theoretically investigate the utility user's perceptions of the TTF as a precursor to variables affecting the use of an 'integrated virtual enterprise utility management' technology as well as to provide an understanding of the innovation's task-technology fit through the user evaluation of technology-fit and motivational features. The intention is to investigate the user perspective in terms of their assessment of the level of which that technology "fits" with their task needs of managing their utilities effectively.

However, this study is adapted from earlier studies on the TTF framework and includes various important factors to be considered in the measurement of information technology innovation in relation to their fit with tasks needs that a user is trying to accomplish. This research has adopted a modified model of TTF theory (Goodhue, 1995), as presented in Figure 3-4 to comply with the theoretical context of this study. It demonstrates the theoretical basis of the model in order to examine the earliest stated research question and hypothesis of this study. The link between fit and innovation technology characteristics and utility task-characteristics is examined when use is voluntary (Dishaw and Strong, 1998b, Dishaw and Strong, 2003, Staples and Seddon, 2004). In which the link between fit and technology innovation, where it occurs, the end users are free of their own accord whether or not to use this technology.

Phase I; User perceived Technology-Fit perspectives

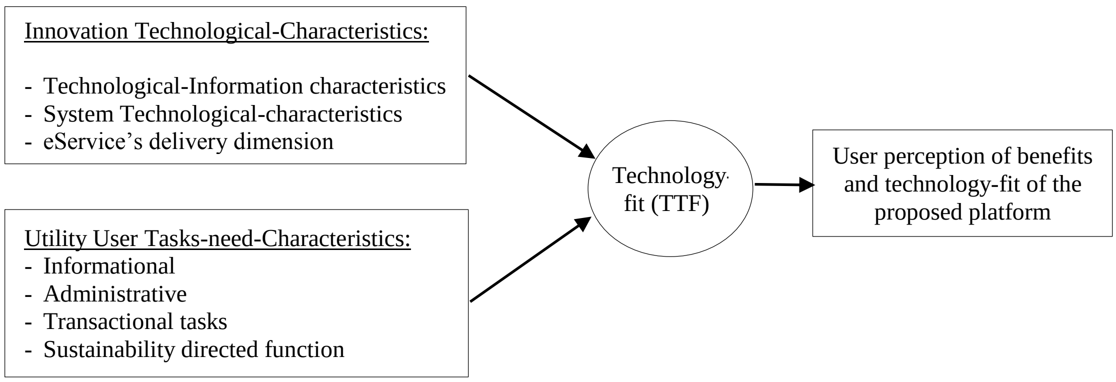

Figure 3-4: User perception of 'technology-fit' of initiation of a 'one stop' technology innovation platform in the context of internet-based user utility management services

The graphical notation employed in this study are those usually applied in the majority of the studies investigating technology TTF (Chen et al., 2006, Dishaw and Strong, 1998b, Dishaw and Strong, 2003, Goodhue, 1998, Goodhue, 1995, Staples and Seddon, 2004, Zigurs and Buckland, 1998, Zigurs et al., 1999). The theoretical framework in the figure displays arrows among the first determinants, utility user 'task characteristics' and the "technology-fit" construct. In addition, between the determinants, "technological characteristics" of 'integrated virtual enterprise utility management' technology innovation and the "technology-fit" aspects are included. None of the arrow notations will suggest a causal association, as they would typically provide. Alternatively, they suggest that it is an association of the particular task together with the technology capabilities, which can predict the fit among them (Goodhue et al., 1997). As a result, neither of the two constructs (task characteristics or technology characteristics) separately will be able to predict the fit. This is in-line with relevant theoretical frameworks applied in previous studies (Goodhue et al., 1997), (Goodhue, 1995), and (Goodhue et al., 2000).

The principle of fit has additionally been applied to another factor of technology matches by associating tasks to technological innovation attributes in a way that affects performance (Zigurs and Buckland, 1998, Goodhue, 1995, Goodhue and Thompson, 1995). With respect to this particular fit perspective, the considered approach of TTF is directly concerned with looking at "the extent that technology functionality matches task requirements and individual abilities" (Goodhue, 1995). To summarise, the technology's fit is usually associated with the technology's capabilities, task demands and individual ability, which in turn can predict the impact on resultant performance.

However, a number of scholars prefer to use the construct of individual characteristics in their evaluation of TTF, presumably because they consider it to be an important variable in the prediction of technology fit. For example, the TTF model was tested with individual characteristics as a dependent variable affecting TTF by Goodhue and Thompson (1995). Despite the interest aroused by such reasoning, most scholars have tended to avoid referring to the construct of individual characteristics within the framework of a TTF evaluation. The essential reasoning behind excluding individual characteristics from the evaluation framework is that TTF is a function of the capability of the technology innovation to support appropriately a given task, which is unrelated to any certain technology user characteristics or ability to achieve that task by means of the selected technology. Taking into account the rationale of this explanation, this study will not include the measurement of individual characteristics in the theoretical research model since it is assumed that they have no impact on user perspectives of task technology fit regards the 'integrated virtual enterprise utility management' model in a utility management context.

Further to this point, a study of technology-to-performance chain (TPC) conducted by Goodhue and Thompson (1995), began by employing individual characteristics as a factor impacting TTF but went on to simply examine a part of the framework not incorporating this measurement construct into the final evaluation. Moreover, other studies investigating the theoretical framework of TTF in information technology considered TTF as being influenced by constructs of task and technology characteristics, as well as other additional factors (Dishaw and Strong, 1998a) not including the measurement variable of individual characteristics. For this reason, this study adopts the measurement of fit employed in prior studies in which the aim is to predict the new innovation task technology fit along with the utility user's task demands despite the variant in individual attributes and ability.

The purpose of this study is to understand how these pre-determinants of the TTF framework interact with each other to influence user intentions to adopt the research technology innovation model (of an 'integrated virtual enterprise utility management' framework). Furthermore, this model may more accurately reflect task-technology fit and other important facets of study with regards user intentions to adopt the technology innovation in its consideration of technology acceptance and adoption theories. The following sections will describe in detail the measurement constructs of the proposed TTF theoretical framework for testing the research model from user technology-fit perspectives in an online utility management context.

The model of investigating user technology-fit perspectives in this study constitutes a synthesis of two research dimensions identified by Goodhue (1995) since pre-technology use attributes that impact the user perspective towards technology-fit. Those aspects are identified as innovation technological characteristics and task characteristics, which were suggested to be an effective measure of the user technology-fit perspective affecting user intention, specifically at a prior stage of using such technology innovation. The subsequent sections give a detailed explanation of the TTF framework dimensions of measurement that have been suggested in Figure 3-4 in order to evaluate the user perspective of technology-fit. This is followed by an explanation of the proposed operational and measurement constructs of 'technology fit' as an independent variable affecting user perspectives towards the conceptual research model.

3.3.1.1.1 Innovation technological-characteristics as independent variable

Previous studies of TTF have investigated a large variety of technological innovation characteristics with relation to the user perception of technology-fit and consider innovativeness of technology innovations as an important factor. A number of studies have looked at the general elements related to technology characteristics. However, others have specifically selected technology characteristics for evaluation. Various TTF studies have investigated the relationship between technology characteristics and TTF in a variety of areas relating to technology applications, such as: the technology of group support systems (Zigurs and Buckland, 1998, Zigurs et al., 1999), database applications (Goodhue et al., 2000) and software engineering tools in relation to support tasks of software maintenance activities (Dishaw and Strong, 1998b, Dishaw and Strong, 1999, Goodhue et al., 2000).

However, it is obvious that the literature review indicates that no relevant TTF studies relevant to the context of innovative technologies for online utility management services currently exist. Thus, this study defines the technological innovation characteristics by referring to those attributes associated with the specific technology dimensions applied in related literature in the similar field of information technology and electronic services of e-government, e-business, e-banking and e-commerce in order to study user perspectives of technology-fit and satisfaction.

The main suggestion of the TTF framework is that for the effective measurement of technology innovation satisfaction, users would be required to assess how best this technology fulfils their particular requirements. This theory implies that the association with performance might be strengthened in cases where end user assessments concentrated on how precisely the technology innovation fits with the tasks requirements. (Goodhue and Thompson, 1995) stated that TTF is an objective assessment framework similar to undertaking an engineering analysis of technology feature attributes; user's task needs and then evaluating the match between them. He indicates that inquiring of end users their views about task-technology innovation fit will become a great alternative to a technological engineering analysis approach. However, testing the technology innovation characteristics with regard to the presence of appealing technology characteristics assumes that end users realise which innovation characteristics tend to be desired and that the user will be efficient and skilled enough to assess if such technology innovation involves those characteristics or not. On this matter, this study will employ the measurements of technology characteristics corresponding with those widely accepted in literature on information technology success (such as; DeLone and McLean Modified model of information system success ('net-benefits') (Delone, 2003) , technology acceptance model (TAM) (Davis, 1985), diffusion of innovation (DOI) and perceived characteristics of innovation (PCI) (Moore and Benbasat, 1991)), in order to identify a set of guidelines that researchers have adopted in the assessment of technology innovation capabilities and features. Thus, this study incorporates the appropriate prominent theoretical model of prior studies relevant to technology characteristics and information system success, which is originally defined by DeLone and McLean (1992).

It has been previously asserted that the characteristics of information technology have an impact on end user satisfaction. This conclusion is supported by the research of McKinney and Yoon (2002). If the technology innovation characteristics do not fulfil the users' expected values, that technology will be ignored by the users (Yu et al., 2004). Thus, this study assumes that a utility user perspective of the technology fit of the 'integrated virtual enterprise utility management' model is impacted by the technology's innovation characteristics in addition to other TTF measure constructs. The three main measurement dimensions of technological characteristics that will impact information system's success as defined by DeLone and McLean will be employed in this study, including: i) informational, íí) system, and iii) electronic services delivery. The three aspects were modified to suit the definitions of the measurement constructs of technological characteristics in the context of utility management as outlined in the main research model of this study. The different technological innovation characteristics obtained from the literature have been determined and allocated the appropriate measurement of information success in order to formulate the final determinants suitable for application in a user-centric utility management service context. The resultant measurement constructs are illustrated in Table 3-1.

Table 3-1: Measure of technological characteristics for 'one stop' technology innovation platform

DeLone and McLean (DeLone and McLean, 1992) IS success Dimension	Decomposed of technological characteristics
Technological information dimension	- Integrated/shared information environment - Sustainability Informative medium - User-centric information technology
Technological system dimension	- Single windows administration - User Profiling - Stakeholders integration and service exchange Operability - Collaborative virtual enterprise (VE) infrastructure
Technological online services delivery dimension	- 'One-stop' service delivery paradigm - User-centric services - Integrated online services portfolio - Personalization and customization - Sustainability-centric services design - Access channel medium

3.3.1.1.2 Innovation user-task characteristics as an independent variable

Similar to previous explanations of fit for technology characteristics, the task-technology fit theory refers to the degree of technologies capabilities to suit user task characteristics that supposedly would have an impact on user's adoption of such technology.

As concluded in Goodhue and Thompson's (1995) study, the tasks can be explained as the activities taken by individuals in order to transform inputs into outputs (Goodhue and Thompson, 1995)). "Tasks of desire" are likely to be tasks carried out by users that could possibly impact their intention to use technology innovation. User characteristics, for example, a previous understanding of technology, motivations, self-efficacy, ability and skills that possibly impact their perception of the complexity of using such technology innovations may also affect their usage performance. TTF theory focuses on the suitability of the technological innovation in assisting user task requirements. It is equivalent to the description of task-information-system fit defined by Goodhue and Thompson (1995), which described task-information-system match as the degree to which technology characteristics can support an individual in accomplishing their task requirements. Generally, the TTF theoretical framework defines the "fit" as the level to which technology characteristics are suited to a particular task. In this study we use the following similar meaning of task-technology fit. TTF is a matching of the 'integrated virtual enterprise utility management' model's functional capability with the utility user's needs of the tasks to be accomplished.

As found in the literature review, the task-characteristics are commonly employed as measurement constructs for assessments of technology fit in the TTF framework. It was common practice by previous researchers to examine the effects of task-characteristics on the use of innovation technology (Goodhue and Thompson, 1995). The literature review shows that a variety of tasks selected from different research areas of technology applications have been examined in previous studies of TTF theory such as consumer task characteristics fit in e-commerce (Klopping and McKinney, 2004), group support systems (Zigurs and Buckland, 1998, Zigurs et al., 1999), systems maintenance (Dishaw and Strong, 1998b, Dishaw and Strong, 1999), decision making (Goodhue, 1998, Goodhue and Thompson, 1995) and tasks of searching in an e-library catalogue system (Staples and Seddon, 2004).

By reviewing the literature available on TTF as well as considering the formulation of the "fit" concept, as introduced earlier in previous studies, it can be concluded that most research in the field has employed the TTF measurement construct in order to examine how effectively the features of certain technology innovations match the requirements of the task being accomplished (Dishaw and Strong, 1998b). The technology's "fit" refers to "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue, 1995). In order to assess the fit of tasks with technology capabilities this study adopts a definition of fit as defined by Venkatraman (1989), which explains the task-technology fit assessment from the user evaluation perspective. Thus, the match is viewed as the association between the characteristics of a task to be accomplished and the functionality of a certain technology to support such tasks (Sambamurthy and Adviser-Desanctis, 1989).

In this study, the TTF framework is defined as the match between utility user task characteristics and the 'integrated virtual enterprise utility management' model being investigated, where this study has the opportunity to deal with this particular research gap and deliver contributions to the study of task characteristics in a utility management context from user perspectives and with regards the link with the technology's capacity to provide an efficient means of performing such activities. In similar research domain, various tasks have previously been examined using the task-technology fit theory and the review of such literature indicates that no studies are currently found to be related to utility users' task needs for the goal of internet management of utility services online. Furthermore, such tasks rationally require the appropriate technology attributes and the electronic services delivery model to be available over the web enabling users to accomplish their task needs related to the achievement of efficient utility service management in their property.

In this study, where utility tasks were required to be carried out through the completion of different tasks from several information technology resources, a particular theoretical definition of utility user-tasks was formulated. Similar to other e-society technology applications, the utility user is identified to be a customer of business agencies interacting with Internet services on the web. Thus, this study adopts a similar definition of online user as defined by previous study in the e-banking domain conducted by Burton-Jones and Straub (2006). In the context of this study, the online utility user is an individual person who uses electronic utility services on the Internet to perform their task needs managing utility services online. The electronic utility management services in most cases tends to include providing the utility users with the ability to check their utility accounts, pay bills online, perform transactions electronically and much more.

From a comprehensive task-characteristics perspective in the utility management context, the user's tasks can be described as activities carried out by utility users to perform informational, administrative or transactional tasks online supported by the available technology innovation and electronic services over the web that enable users to meet their needs. In this study, the TTF is determined through matching characteristics of the 'integrated virtual enterprise utility management' model to the utility user task characteristics in order to assist in the activities of managing utility services efficiently by means of the functionality of the proposed technology innovation framework. The utility user task characteristics are obtained by transforming services and uses into tasks with consideration of expected outcomes and the provision of a services definition found in previous studies on an electronic services delivery approach that focus mainly on providing a user-centric service.

A previous study by Sannes (2001) suggested a model of classifying technology services with regard to their value-added services from user-centric perspectives of e-business services. It introduced three major task categories: transactional, customer service and user self-help. A following study conducted by Southard and Siau (2004) redefined the customer service and self-help categories as informational and administrative, respectively. This study adopts the definitions given to task categories as outlined by Southard and Siau (2004). The modified definition of user tasks that will be adopted in this study to suit the utility management context is a classification of the electronic services provided to utility users in three main task categories. These include: informational, administrative and transactional aspects. Table 3-2 illustrates the task categories in a utility management context with an explanation of the associated services alongside each category.

Table 3-2: Measure of utility user-task characteristics for ‘One stop’ innovation platform

Task characteristics dimension	Decomposed utility user tasks
- Informational	- General utility service information - Utility services news and status alerts - Subscription status information - Information of service regulations updates - Consumption status information - Avatar informational advices
- Administrative	- Account Information Access - Utility subscription/account management - Real-time monitor/ Control/analyse of consumption - Financial/cost management services
- Transactional services	- Set-up account - Transfer account capabilities - Change tariff scheme services - Bill-payment services - Utility services status management

- Sustainability involvement function	- Sustainability knowledge and awareness functions - Setup resource usage goal setting - Consumption feedback and usage demonstration - Control and monitoring function - Consumption efficiency analytical functions - Regional/neighbour comparative feedback - Pro-environmental user-specific recommendation function - Engagement in sustainability campaigns - Link with sustainable parties (sustainable communities, policy makers, sustainable solution industries …etc.) - Sustainable lifestyle performance labelling and rewards functions

The 'integrated virtual enterprise utility management' technology innovation characteristics were categorized into three task areas: informational, administrative and transactional, as follows:

Informational

As previously mentioned, the informative services include basic utility information that is generally to be found in the utility service provider's physical branch office. These electronic informative services normally consist of general information and an explanation of available services, whilst additional information describes utility subscription services. In some instances, informative services do not require the utility service providers to allow the users access to its internal LAN network and the informational services are not linked to specific utility user accounts, whereas a number of informative services require a subscription and need to be linked to utility user account information (i.e. account management, bill payment, utility usage consumption feedback etc.), which is usually provided based on a predefined user authentication process. Due to the fact that general information is sometimes offered to the public, informative services require a design that allows them to be easily accessed with minimum security, while other advanced informative services are authenticated to certain users.

Administrative services

Administrative services include capabilities that will allow utility users to accomplish different administrative activities, such as obtaining utility account details and acquiring services related to utility account subscription with the service providers. These functions include interaction with the utility service providers' technology infrastructure and database, which usually requires that the user use their credential authorisation information to access their accounts online using the electronic service available on provider's websites.

These services also contain functional capabilities such as gauges of utility consumption, account management, selection of service tariff plan etc.

Transactional

The transactional services include capabilities that enable users to actually complete their activities of utility management tasks and conducting transactions. Similar to the administrative services, these functions require an interaction with the utility service provider's internal technology infrastructure. It involves capabilities that link the utility user through the utility service providers' network to other sources of electronic services of interest. These other sources of electronic services may provide additional services, such as local regulator information, national statistical information of utility resource consumption, pro-environmental and sustainability information or other valuable information considered appropriate by the utility service providers. However, the hierarchical structure of the agencies and issues relating to security concerns must be considered while providing such services, where in common scenarios, these transactions are most likely to be carried out within the entire workflow system of service provider agencies and entire information databases are updated.

3.3.1.1.3 Construct operationalisation and measurements framework; Technology-fit as a dependent variable

The concept of "technology-fit", as introduced by Goodhue (1988, 1995) and Goodhue and Thompson (1995), has been employed to present the theoretical framework for a user assessment of fit between information technology services and user task technology needs. This measurement framework has been applied in the examination of user evaluations of technology fit antecedent to the technology use and to the outcome or consequences of utilisation (Goodhue and Thompson, 1995, Goodhue, 1995).

As identified above and presented in Figure 3-4, this study employs the 'technology fit' measurement construct as a dependent variable. This approach is appropriate for the purposes of this research and is theoretically justified. The TTF measurement will be used to evaluate the match between the 'integrated virtual enterprise utility management' model with related factors such as technological characteristics and user task needs, as well as to investigate the appropriateness of such model in utility service management from a user perspective.

The allocation of 'technology fit' as a dependent variable is supported by the TTF theoretical framework on which this study is based. A better technology fit allows the prediction of a positive user perspective regards the resultant benefits of using such a technology (Goodhue and Thompson, 1995).

User expectations of positive benefits gained as a result of technology usage are antecedent factors in the prediction of actual technology use and better performance (Davis, 1989, Mathieson, 1991, Adams et al., 1992). Thus, 'technology fit' is asserted to be a factor having a direct impact on the positive expected outcomes of utilisation. The ‘technology fit’ construct is largely examined as a dependent variable in relevant studies and widely applied as an outcome measurement in information technology research in causal association with the main TTF framework constructs that comprise: technology characteristics, task characteristics and individual characteristics (DeLone and McLean, 1992). As a result, for the reasons given, 'technology fit' is identified as a dependent variable in our research model.

According to studies evaluating the fit of user tasks with technology innovations, two dimensions of importance can be concluded from the literature: 1) the “fit” evaluator and 2) the methodology of evaluation. The ‘technology fit’ evaluation process can be carried out with either the technology users or researchers acting as evaluator. The user evaluation of “fit” is the approach undertaken by the researcher in order to evaluate the task-technology fit of a specific innovation in technology by surveying the user perspectives of how the technology is deemed to match with their task needs using a questionnaire as a research instrument. The user evaluation of fit was applied in a number of studies, for instance, McCarthy ((2002a) and (McCarthy, 2002b)) uses a questionnaire based on TTF constructs (Goodhue, 1995) to evaluate the task technology-fit of knowledge management technology by asking the user to assess the technology fit with their task needs. Another study conducted by Benslimane et al. (2003) obtained a buyers assessment of technology-fit outlining their perspective on technology features matching with their task needs. Furthermore, a technology in library services was evaluated for technology-fit by their users. The measurement of cataloguing technology tools fit with users’ needs was conducted by questioning library users about their perception of match between the technology and their tasks (Staples and Seddon, 2004). In addition, there are other studies in which researchers provide the actual evaluation of technology-fit based on their previous knowledge about the technology. For example, studies carried out by Zigurs and others

(1998) (Zigurs et al., 1999) have evaluated the technology "fit" regards a portfolio of tasks that they designed. Other researchers conduct the assessment using a theory-based measurement of fit between the characteristics of the task and the characteristics of the technology (Lim and Benbasat, 2000).

In this research, the methodology that was deemed appropriate is the user evaluation of fit with author support to strengthen the user evaluation based on their previous experience and knowledge in the context of utility management services and technology. Having described who evaluates the technology fit, an additional dimension for exploration suggested by the relevant literature is the methodology to be applied for the assessment of "fit". Earlier research provided by Staples and Sedon (2004) explains two methods of evaluating "fit": a) the facets-of-fit approach; and, b) the predicted-outcomes approach. The facets-of-fit method assesses whether key requirements are met and the predicted-outcomes approach assesses whether use of a given toolset would lead to the desired outcomes. This research employs the second method of measuring "fit" since the predicted-outcomes approach is deemed appropriate for investigating potential technology benefits from the user perspective based on the nature of the research problem that was earlier defined.

3.3.1.2 User potential 'net-benefits' perspective

It is commonly recognised that an understanding from the user perspective of benefits to be derived from technology innovation is a direct antecedent to their attitude towards using such a technology. This is in line with the purpose of the first stage of this study (phase I). The second part of the evaluation of user perceptions of TTF was to understand how the pre-determinants that interact with each other influence utility user perceptions of the net-benefits of the 'integrated virtual enterprise utility management' model. To this end, this study formulates an appropriate theoretical validation model, as shown in Figure 3-5. This study differs from previous scholars employed different empirical methods to examine information technology benefits without making any attempt to underpin such a framework theoretically (Torkzadeh and Doll, 1999, Saarinen, 1996, Bonner, 1995, Gable et al., 2008). It uses a well-defined theoretical framework underpinned from the literature to evaluate the user perspective of potential net-benefit of the conceptualised technology innovation model defined in this study. The following section will describe in detail the model's measurement constructs, as displayed in Figure 3-5.

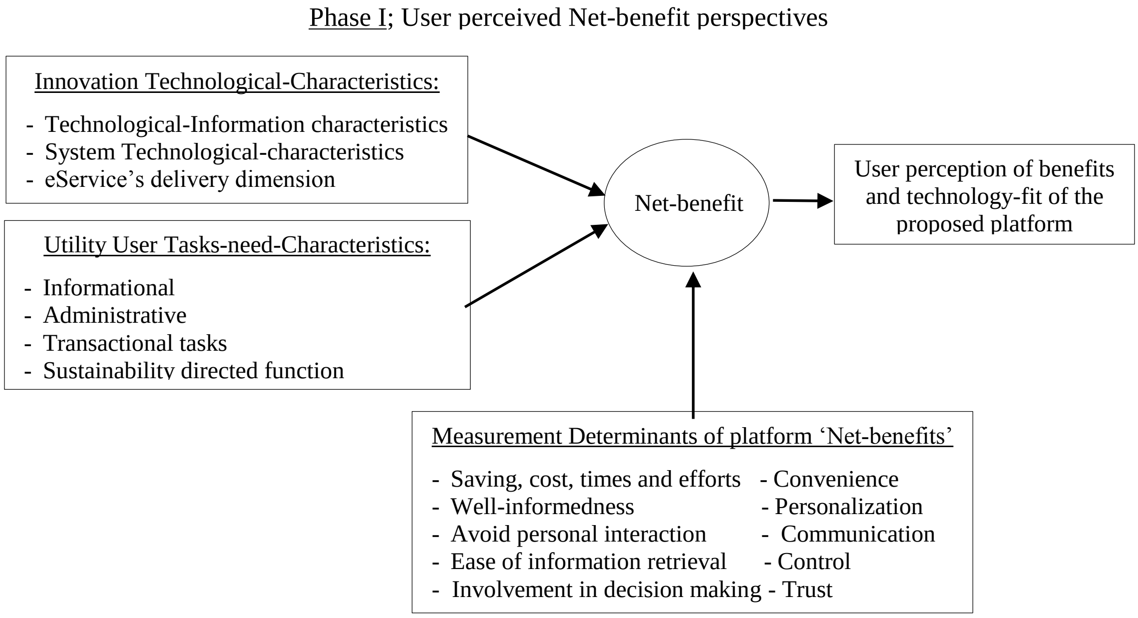

Figure 3-5: User perception of Net-benefits of initiation of a 'one stop' technology innovation platform in the utility management context.

3.3.1.2.1 Construct operationalisation and measurements framework: 'Net benefits' as dependent variables

The development of a comprehensive framework to evaluate technology 'net-benefits' is fragmented in the research area of information systems success and electronic service delivery approaches. Most researchers assessments on technology benefits concentrate specifically on the influence of information technology on the work environment (Petter et al., 2008). The measurement constructs of 'net-benefits' are commonly adopted in previous research studies in relation to the assessment of job impact and perceived usefulness of technology innovation (Adams et al., 1992, Segars and Grover, 1998). In the area of evaluating the benefits of technology innovation and electronic services delivery, there is a need to employ appropriate measurement constructs that can precisely estimate the expected technology benefits that users may perceive by using such technology innovation.

While some studies have employed such measurement constructs, there is a lack of research that empirically examines the technology benefits from the user perspective (Christopher G, 2005). However, in this study the evaluation of the user perception of 'net benefits' of the initiation of an 'integrated virtual enterprise utility management' framework was underpinned by the prior theoretical framework, as described in Scott et al.'s research (2011) where an appropriate instrument for 'net-benefits' measurement was formulated. This study provides a measurement of user perception regards net benefits in order to investigate the potential effects of the 'integrated virtual enterprise utility management' framework on user satisfaction. Specifically, the aim of this study is to employ a comprehensive 'net-benefits measurement construct, based on the prior approach of Scott et al. (2011) in order to assess the impact of an 'integrated virtual enterprise utility management' framework with different technological dimensions (information quality, systems quality and service quality) and functionality (task-characteristics) on user's perspectives of added-value of such technologies and in turn to the success of technology innovation.

Following this process, eleven dimensions were determined to be affecting user perspectives of technology 'net-benefits'. The dimensions are: cost, time, communication, avoidance of personal interaction, control, convenience, personalisation, ease of information retrieval, trust, knowledgeability and participation in decision-making (see Table 3-3 for details). The dimensions correspond to the overall focus on user perceptions of 'net-benefits' of the initiation of 'an integrated virtual enterprise utility management' model as conceptualised in this research.

Table 3-3: 'One stop' technology innovation platform net-benefits

Net-benefits Constructs	Definition (Author)	Underpinning references from previous studies
Cost	The user's perception of the potential cost saving from using the innovation.	(Gilbert et al., 2004)
Time	The user perception of the potential time saving from using the innovation.	(Gilbert et al., 2004, Kolsaker and Lee-Kelley, 2008, Wang and Liao, 2008)
Communication	Efficiency of communication with all utilities parties.	(Kolsaker and Lee-Kelley, 2008)
Avoidance of personal interaction	The completion of utility management tasks without face-to-face interaction with customer services staff.	(Gilbert et al., 2004)
Control	The technology innovation's capacity to enable the user control over the services.	(Gilbert et al., 2004, Grimsley and Meehan, 2007)
Convenience	The user being comfortable with the technological innovation and service delivery approach.	(Gilbert et al., 2004)

Personalization	The innovation's ability to provide a personalised user service based on their preferences.	(Gilbert et al., 2004, Kolsaker and Lee-Kelley, 2008)
Ease of information retrieval	The level of ease with which utility service information can be obtained.	(Kolsaker and Lee-Kelley, 2008)
Trust	User confidence with the innovative technology services.	(Teo et al., 2008, Warkentin et al., 2002, Welch et al., 2005)
Knowledgeability	How well informed/knowledgeable about utility services and resource consumption the user is.	(Kolsaker and Lee-Kelley, 2008, Grimsley and Meehan, 2007)
Participation in decision-making	How involved the user is in decisions about environmental sustainability.	(Kolsaker and Lee-Kelley, 2008, Grimsley and Meehan, 2007)

In summary, this section presents the developed theoretical validation framework in order to meet the first objective of this study (phase I) namely, an understanding of how these pre-determinants interact with each other to influence user perceptions of both technology fit and the net-benefits of the initiation of an 'integrated virtual enterprise utility management' model in the utility management context. In the following section, the formulation of the second theoretical validation framework of investigating user perceptions of innovative technology acceptance (phase II) will presented and underpinned by related theories of user technology acceptance and innovation adoption.

3.3.2 Phase II: User acceptance of the technological innovation

In the previous section, a precise definition of the theoretical model (phase I) of investigating the user perspectives of 'task-technology fit' of the 'integrated virtual enterprise utility management' concept of this study was provided. Other facets of user perspectives towards the new technology innovation model were identified as important factors in the investigation of future technology success and user acceptance. User technology acceptance and innovation adoption have been acknowledged in previous literature as key factors affecting a user's future technology use. It is apparent that user reactions to emerging technological innovations and the new eService delivery approach have been important topics in recent information systems research. In previous studies, different aspects of user intentions regards innovation adoption have been formulated from a variety of theoretical perspectives ranging from technology acceptance, theory of diffusion of innovation, PCI and the motivational theoretical model. These previous theoretical frameworks provided the motivation in this study to develop an appropriate theoretical evaluation framework suited the context of this research. This was underpinned by theories of technology acceptance, innovation adoption and PCI. The theoretical framework (phase II) used to evaluate user intentions to accept/adopt the 'integrated virtual enterprise utility management' model is defined and illustrated in Figure 3-6.

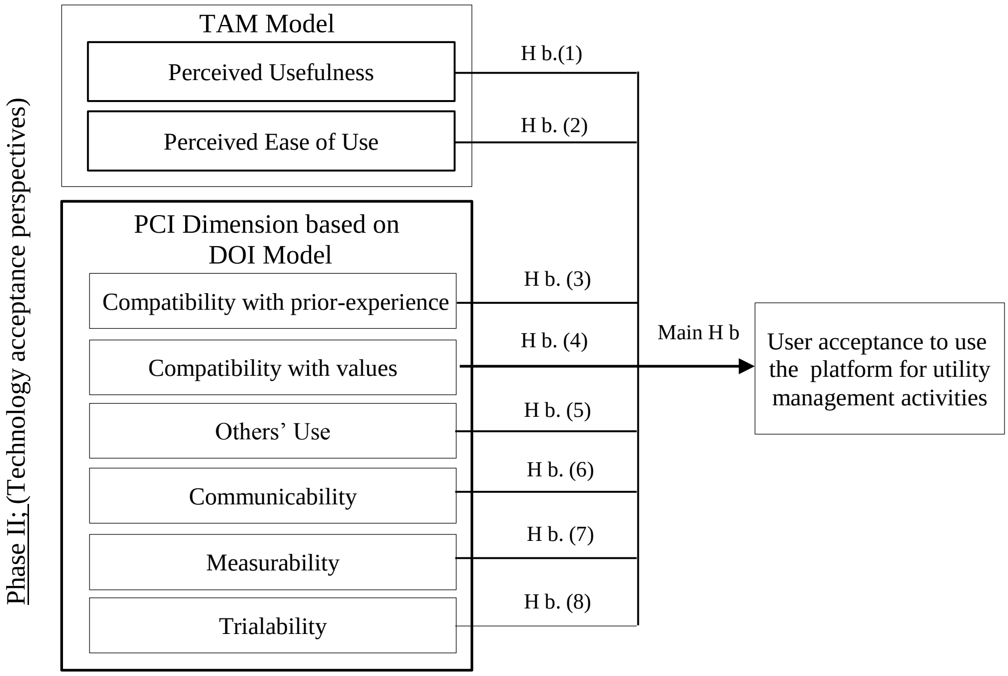

Figure 3-6: User intentions to accept use of the 'integrated virtual enterprise utility management' platform in the utility management context.

This section intends to build upon the literature review and to present an in-depth discussion about the development of the theoretical evaluation model that will be used in second stage of evaluating user perspectives towards the research conceptual model (the theoretical framework constituting phase II of the research). The purpose of developing this research model is to answer the second research question of this study. The theoretical framework is underpinned by the TAM, DOI, and PCI theories that provide its basis. All of these theories have been employed as a basis for developing the research theoretical framework (phase II), and the resultant model is shown in Figure 3-6 and discussed in detail in section 3.3.2.2.

3.3.2.1 Theories of TAM and DOI

Recent studies have employed different models in order to describe or predict the users' technological innovation acceptance. These studies have investigated the users' intentions to accept technology innovations using different theoretical models, including TAM, the Theory of Planned Behaviour (TPB) (Choi and Geistfeld, 2004, Ajzen, 1991), the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), and Innovation of Diffusion Theory

(IDT). TRA has been used in the past to explore and predict users' acceptance of technology; TAM is considered to be an adaptation of TRA (Lu et al., 2005). However, TRA has limitations, which have been observed when using the users beliefs as a factor affecting their attitude (Yu et al., 2005).

As concluded from the relevant literature, TAM theory was widely considered the theoretical model of investigating technology innovation acceptance and utilisation, especially because of its focus on demonstrating the important impact of users' perceptions of a technology's advantages and 'ease of use' on their intention to use such a technology.

The importance of TAM as a model is its ability to predict future technology innovation utilisation; a fact recognised empirically in previous studies carried out by Davis (1993, 1989, 1989) and others (Adams et al., 1992, Mathieson, 1991, Moore and Benbasat, 1991).TAM has been used with more success in past studies than other models (Davis, 1989) taking into consideration two factors (Namely, users' perceived usefulness and ease of use) as main players in affecting users' perceptions of technology acceptance.

TAM, as presented by Davis (1985), has been used in different information system disciplines in order to predict and describe their users' behaviours regards technology innovation as well as their intention to use it (Shih, 2004, Yu et al., 2005). It has also been used in various technology acceptance studies (Bauer et al., 2005, Muk, 2007, Wu and Wang, 2005, Yang, 2007). The main objective of the model is to offer an explanation of the common determinants of technology acceptance, describing the users' behaviour across a broad and diverse range of end-users when using various technological innovations. The model has also been used to describe the users' acceptance of technology or to predict their beliefs and behavioural patterns by focusing on two important constructs: perceived usefulness (PUSF) and perceived ease of use (PEOU). According to the model, the two composite constructs may well predict users' technology usage and their intention to use it. In TAM theory, the degree to which an individual thinks that making use of a particular technology will improve his/her job performance is defined as the 'perceived usefulness' construct, as described by Davis et al. (1989). Meanwhile, the 'perceived ease of use' construct is defined as the degree to which a user perceives that the technology innovation will be effortless (Davis et al., 1989).

TAM suggests the two main constructs (PUSF and PEOU) while disregarding the factor of subjective norm, which has a direct effect on the attitudes of users with regards to using the technology. PUSF refers to the individual's personal assessment of the benefits that result from using a particular technology. PEOU refers to the extent to which the user believes that the technology is simple and effortless to use, which is thought to have a direct impact on the intention to use such a technology (Davis et al., 1989). Furthermore, individuals can be encouraged to use a technology when it benefits them by enhancing their way of conducting their activities, regardless of the personal differences in their preferences.

Legris, Ingham et al. (2003) reviewed TAM-related empirical studies and concluded that TAM is useful in the study of technology acceptance. TAM theory provides a strong link between user perceptions and technology innovation use intention, which is widely acknowledged in the literature. Despite the advantage of TAM being helpful for predicting innovation usage intention, it is obvious that it has some limitations. It is recognised to have shortcomings with regards its capacity to explain the relationships between technology acceptance intentions and innovation characteristics. However, in respect to innovation characteristics, a number of researchers have mentioned that an improvement of innovation features does not necessarily lead to better technology acceptance. These authors suggested that other factors such as DOI and PCI should be added to the model along with technology-acceptance aspects.

Another theory related to TAM in terms of understanding the determinants of user acceptance of technology innovation is Rogers's DOI theory, which has proved beneficial in understanding why some innovations are adopted at a much faster rate whereas others might not be easily accepted even with various advantages. The manner in which the innovations are perceived is also a significant factor in the application of a wide range of innovations, although various studies have considered the perceived characteristics as the main factor influencing the adoption of innovation. The DOI also supports this assertion by stating that the users' perceptions or beliefs about these innovations play a major role in decisions related to accepting or rejecting certain technology innovation, as discussed in DOI theory (Agarwal and Prasad, 1999).

An innovation is defined by Rogers Everett (1995, p. 11) as "an idea, practice or object that is perceived as new by an individual or other unit of adoption". The targeted group of users who might adopt the idea will determine the relative 'newness' of the idea in this case. According to Van de Ven (1986), although some people might consider an idea to be a replica of something that exists elsewhere, it will still be perceived as new as long as the group of users involved consider it as new. This explains the relation of newness of an idea to the innovation. Moreover, Rogers (1995) proposes that the users' attitudes towards an innovation will be shaped by the manner in which the potential adopters consider the innovation. These characteristics of technology innovation have been referred to in previous studies as factors of innovation adoption (Allan and Wolf Jr, 1978, Boz and Akbay, 2005, Carter, 1998, Davis, 1989, Jacobsen, 1998, Martins et al., 2004, Pagani, 2006, Yates, 2001). The rate at which an innovation is adopted is affected by the five PCIs (Rogers, 2010). In comparison to their relevant alternatives, an innovation that has a better relative advantage, compatibility, simplicity, ability to be observed and/or trialled has a greater chance of demonstrating better user adoption. According to Rogers (2010), around 87% of the variance in the rate of adoption of innovations is based on these five innovation characteristics.

In some studies, the adoption of technological innovations in the information systems domain is explained with the help of DOI. The theory of Rogers Everett (1995), which was used as the basis for the PCI by Moore and Benbasat (1991), provides effective measurement instruments that were applied in previous studies of the perceived characteristics of technology innovation (Moore and Benbasat, 1991, Spence, 1994, Taylor and Todd, 1995b, Tornatzky and Klein, 1982) and has been widely used in the information research area and is considered to be the main determinant affecting a user's adoption of technology innovation (Gatignon and Robertson, 1983). The observed conclusion of such previous studies is that an innovation will be adopted faster than others when it is perceived by users as having a higher relative advantage, compatibility, "trialability", simplicity and "observability". Difficult to use innovations will have a tendency towards lesser rates of adoption by the users than those that are less complex. In the following section, a detailed description of the theoretical measurement framework of phase II in this study will be presented.

3.3.2.2 TAM, DOI, and perceived innovation characteristics measurement framework

Several studies have explored the users' adoption of technology innovation by using Rogers's IDT (Rogers, 2010) as a basis for their theoretical frameworks. The adoption of an innovation according to Rogers's (1971) IDT is explained through the PCI, which includes the five innovation characteristics constructs. His results were further supported by his additional research (Rogers, 1983) on the five innovation characteristics, which led him to conclude that these five characteristics of innovation are able to describe 49% to 87% of the variance in the rate of innovation adoption. Rogers's DOI theory identifies five primary innovation characteristics, which are : relative advantage, which refers to "the degree to which an innovation is seen as being superior to its predecessor"; compatibility, which is the "degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of adopters"; complexity, which is the extent to which an innovation is considered difficult to learn and utilise or a user's perception that using a particular technology innovation would be effortless (Davis, 1989); "trialability," which is the degree to which an innovation can be tried out on a small scale; and, "observability", which is the degree to which outcomes resulting from the use of a new idea are visible to other clients. The users' technology adoption for an innovation will be higher than for others if it is perceived by the users as having less complexity, a higher relative advantage, "observability", and compatibility (Rogers, 2010). In previous studies, a strongly positive correlation is found between the users' technology adoption and relative advantage, compatibility, "trialability", and "observability" of an innovation. In addition, a negative correlation exists between the complexity of an innovation and the degree of user technology adoption (Rogers, 1983).

Despite the significant theoretical differences between TAM, as proposed by Davis (1989), and Rogers's (1995) DOI theory, some similarities can be observed. For instance, the perceived ease of use in TAM (Davis, 1989) is closely related to the attribute of complexity associated with the PCIs proposed by Rogers (1995). In addition, perceived usefulness goes side by side with the relative advantage of an idea (Moore and Benbasat, 1991). The extent to which an innovation is considered difficult to use will be partially reflected in the user's behavioural intentions, as suggested by the TAM and DOI theories with respect to the complexity constructs (Davis et al., 1989, Rogers Everett, 1995). The acceptance of an innovation will increase with the ease provided by the technology innovation to users, thus enhancing its usage. Rogers's (1995) idea of perceived complexity is theoretically explained by the argument that the most important predictor of the users' acceptance of innovation is the complexity of the technological innovation. The complexity was defined in DOI (Rogers Everett, 1995) as the extent to which an innovation is perceived as difficult to understand or use. Furthermore, the complexity construct in the IDT (Rogers, 2010) is associated with the ease of use of services or an idea (Davis, 1989). Both perceived ease of use and complexity are similar because they define the user's perceived ease or difficulty of technology usage despite the constructs being named differently. For this reason, the complexity construct and perceived ease of use have been integrated in certain previous studies into the construct of ‘perceived ease of use’ and, similarly, is adopted in the development of the theoretical framework of this study. Furthermore, the research model takes into account the importance of the two TAM constructs and was, therefore, employed in the theoretical examination of the users’ perception towards the technology innovation of this study. The two constructs of TAM, perceived ease of use and perceived usefulness, have been considered as the main contributing factors affecting user adoption. The original definitions of the two constructs were applied where the perceived usefulness is “the degree to which a person believes that using a particular technology will enhance his [or her] performance” and perceived ease of use is “the degree to which a person believes that using a particular technology innovation would be free of effort” (Davis, 1989). Both constructs are similar in meaning and can be combined to diffuse innovation constructs (relative advantage and complexity), as argued by Agarwal and Prasad (1997).

In most related studies, DOI theory has been employed in the aggregate. Some recently published studies have made an effort to explore technology innovation at the disaggregate level (Roberts and Lattin, 2000). The influences of the constructs extracted from IDT on technology innovation and electronic services adoption have been considered by a majority of the studies in relation to e-commerce, e-government, e-banking etc. Recent scholars’ efforts have focused on the aggregate instead of using the overall diffusion of technology innovation and electronic services at the aggregate level. Taking this trend into consideration, the effects of relative advantage, compatibility and complexity on e-commerce were explored by a previous study conducted by Verhoef and Langerak (2001). The factor of compatibility with relation to e-commerce was introduced into TAM theory by Chen (2002) and Tan (2004). Another study by Eastin (2002) explored the four constructs of: compatibility, reliability, complexity and relative advantage in order to investigate their influence on users’ frequency use of e-commerce technology.

DOI (Moore and Benbasat, 1991, Rogers, 2010, Compeau et al., 2007) and TAM theories are considered as the most recent works in the area of explaining and predicting the acceptance and use of information technology by end users; thus, both the TAM constructs and six constructs of PCI were incorporated in the theoretical model of this study, which combined all the components of previously discussed models into a single predictive structure. The combined structure was more powerful in its prediction than the individual attributes. Both of the PCIs proposed by Rogers's (1995) and TAM constructs were used in formulating a research model to predict the adoption of an 'integrated virtual enterprise utility management' model by utility users and to explain adoption of technology innovation and electronic services in the utility management context in a virtual enterprise environment (Figure 3-6). The theoretical model comprises of two parts: TAM constructs (perceived usefulness (PUSF) and perceived-ease-of-use (PEOU)) and PCI inverted from the DOI theoretical framework used in previous studies, which have been adopted in this study. Detailed theoretical measurement framework is presented in the following section.

3.3.2.3 Construct operationalisation and measurements framework: 'User technology acceptance' as dependent variables

As regards to user technology adoption, scholars have identified different factors that play a role in the users' acceptance of innovation in the e-commerce, e-banking, e-shopping and private sectors in general (Gefen et al., 2003, Van Slyke et al., 2004). The users' adoption of electronic services in e-government based on similar factors has also been studied (Warkentin et al., 2002). Therefore, considering the similarities of research on users' adoption of electronic services in the private sector (e.g., electronic commerce, e-banking), it is obvious that electronic services in the utility context is a key part of the electronic services in the private sector. Therefore, the users' adoption of electronic services in the utility context can adopt the theory and determinant factors of DOI, PCI and TAM used in previous research to predict the users willingness to use the framework of the 'integrated virtual enterprise utility management' platform (or 'one-stop' model).

Moore and Benbast (1991) defined PCI based on DOI (Rogers, 1995), which has been widely used in the field of information systems to explain and predict the users' adoption of technology innovation. Based on similar previous research that measures and predicts the users' intention to accept technology innovation, (Tornatzky and Klein, 1982, Moore and Benbasat, 1991, Straub et al., 1999, Plouffe et al., 2001, Van Slyke et al., 2004), it is clear that the different characteristics of innovation have had a major effect on the users' behavioural intentions to use the innovation. Moore and Benbasat (1991) have defined the eight PCI factors as determinant attributes affecting users' intention to use or adopt an innovation, these factors include: relative advantage, 'compatibility (with prior - experience, values), ease of use, result demonstrability (communicability, measurability), image, visibility (others' use), trialability, and voluntariness.

As regards to user technology innovation adoption, the users are willing to adopt new technology innovations of technology if they have positive perception towards their related advantages, if the innovation is less complex, and if the innovation is compatible with their prior experiences and values. Relative advantage refers to how the users perceive the relativeness of the innovation to their needs and the gained benefits over other available alternatives. Relative advantage is defined as ‘the degree to which an innovation is seen is perceived as is better than its predecessor’ (Moore and Benbasat, 1991) whereas compatibility refers to ‘the degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of adopters’. Perceived ease of use is ‘the degree to which a person believes that using a particular system would be free of effort’ (Davis, 1989). Although trialability, result demonstrability (communicability, measurability), and others’ use do not represent benefits in themselves, they can be seen as enablers of potential adopters to evaluate the expected benefits of the innovation. Others’ use and result demonstrability (communicability, measurability) might reveal the expected outcomes that can affect the users’ motivation to adopt the innovation (Meuter et al., 2005). Such attributes can positively affect the users’ perceptions related to adopting the innovation. Trialability might help users recognise the attributes of the innovation by enabling them to practice their functionality. This can help users assess the expected effort and change in their skills and behaviours that are required to adopt the innovation. In a related study, Meuter et al. (2005) demonstrated that trialability can increase the users’ readiness for innovation adoption by enabling them to realise the attributes of the innovation and become more confident in their skills and ability to use it. Thus, trialability can affect the users’ perceived feasibility of the innovation characteristics. This study adopts the method of previous research that has employed TAM, DOI theory and PCI to predict users’ intention to accept the innovation.

The relationship between the model’s measurement constructs and the user intention to accept the ‘integrated virtual enterprise utility management’ model will be tested in the final hypothesis. As part of the model, the measurement construct of PCI has been proposed by scholars and has also been employed in the model to measure the users’ perception of technology innovations. In the current study, TAM and PCI based on the DOI theory have been used to investigate the users’ perceptions towards acceptance and satisfaction with the innovation of an ‘integrated virtual enterprise utility management’ as a new technology and the electronic services delivery approach in a utilities management context and virtual enterprise environment. The use of this measurement model as the basis of and providing the analysis in other studies conducted in this area helps to identify the various factors that can affect the users' adoption of technology innovation in utility management services. A previous study by Liao and Cheung (2002) has shown that the users' expectations and perceived convenience of the services provided are the main factors determining their supposed usefulness, leading to acceptance of the technology services. In the current study, the PCIs will be used to investigate utility users' perceptions of the technology innovation of 'integrated virtual enterprise utility management' as well as to predict their intention to use this innovation among different utility users (Figure 3-4). However, the image and voluntariness constructs of Moore and Benbasat's (1991) PCI measurement instrument have been removed from this study's evaluation theoretical framework. The researcher firmly believes that the use of the Internet to conduct utility transitions online is no longer elevating a person's status in the social system, meaning that the use of the image study variable is no longer relevant. In addition, the researcher points out that the image construct was actually a part of the relative advantage construct (Agarwal and Prasad, 1997). The researcher also believes that a user is free from any pressures to use the technology innovation of 'integrated virtual enterprise utility management', which further implies that the inclusion of the voluntariness construct is also irrelevant. Finally, the study of intention under the influence of external pressures leads to no conclusions (Agarwal and Prasad, 1997).

As image is considered to be of least relevance in internet-based utility management, this study will also remove such constructs of image and voluntariness introduced by Moore and Benbasat (1991) from this study model. The relevance of these constructs has been reduced in recent times as internet-based utility management is conducted mainly by utility users in a subjective manner. Voluntariness, as proposed by Moore and Benbasat (1991), was also not relevant for this study, where the user acceptance of technology innovation and use of electronic services to be investigated from the user perspectives and not from an organisational context. A detailed definition of the measurement constructs used in this study's is sown in Table 3-4.

Table 3-4: Innovation characteristics measurement constructs of integrated virtual enterprise utility management platform ('one-stop' model), relevant models, and references

Base Theory		IDT; PCI Measurement Defined by; Rogers (2010), , and Rogers (1995	Moore and Benbasat (1991)	Compeau et al. (2007)	Definition of Construct	Relevant studies
TAM Theory	Perceived Usefulness	Relative Advantage	Relative Advantage	Relative Advantage	The degree to which an innovation is perceived as better than the idea it supersedes. Relative advantage is often referred to in terms of convenience, savings of time and effort, and decrease of comfort in adopting or using innovation: the higher the perceived relative advantage, the more likely the innovation will be adopted.	(Horst et al., 2007, Wangpipatwong et al., 2008, Huang, 2006, Tung and Rieck, 2005, Gilbert et al., 2004, Warkentin et al., 2002, Wang and Tang, 2003, Ha and Stoel, 2009, Venkatesh et al., 2003, Pikkarainen et al., 2004, Moore and Benbasat, 1991)
			Image	Image	'The degree to which use of an innovation is perceived to enhance one's image or status in one's social system' (Moore and Benbasat, 1991); adapted by (Venkatesh and Davis, 2000)	
	Ease of use	Complexity	Ease-of-use	Ease-of-use	'The degree to which an innovation is perceived as relatively difficult to understand and use'. Innovations that are perceived to be easier to use and less complex have a higher likelihood of being accepted and used by potential users.	(Wangpipatwong et al., 2008, Phang et al., 2005, Gilbert et al., 2004, McKinney and Yoon, 2002, Wang et al., 2005, Cao et al., 2005, Ha and Stoel, 2009, Ho and Ko, 2008, Venkatesh et al., 2003)
Selected revised PCI measurement constructs based on DOI theory		Compatibility	Compatibility	Prior experience	'The degree to which an innovation is perceived as consistent with the existing values, past experience and needs of potential adopters'. An innovation is more likely to be adopted when individuals find it compatible with their past experiences, beliefs, and the way they are accustomed to work. When their needs are met, a faster rate of adoption usually occurs (Rogers, 1995)	(Karahanna et al., 1999, Van Slyke et al., 2004, Carter and Belanger, 2004a, Reddick, 2005, Wang et al., 2005, Hernandez and Mazzon, 2007, Venkatesh et al., 2003, Vijayasarathy, 2004, Moore and Benbasat, 1991)
				Preferred work style		
				Values		
		Observability	Visibility	Others-use	Originally defined as the degree to which the results of an innovation are visible to others and communicable (Rogers, 1995). The more easily individuals could observe the positive effects of an innovation, the greater its chance of acceptance was. Innovation observability is also influenced by their peers' use of the innovation. The more potential users see their peers use the innovation (i.e., others' use), the more they will see it as advantageous and easy to use (Compeau et al., 2007).	(Hernandez and Mazzon, 2007, Venkatesh et al., 2003, Hsu et al., 2007)
			Result Demonstrability	Communicability		
				Measurability		

Base Theory	IDT; PCI Measurement Defined by; Rogers (2010), , and Rogers (1995	Moore and Benbasat (1991)	Compeau et al. (2007)	Definition of Construct	Relevant studies
	Trialability	Trialability	Trialability	'The degree to which an innovation may be experimented with on a limited basis'. New ideas that can be tried on the instalment plan are generally adopted more rapidly than innovations that are not divisible (Rogers, 1995). Users might adopt an innovation if they are given the opportunity to try the innovation because it provides a means for potential adopters to reduce the uncertainty of outcomes they feel towards an unfamiliar technology (Weiss and Dale, 1998)	(Hernandez and Mazzon, 2007, Venkatesh et al., 2003, Agarwal and Prasad, 1997, Hsu et al., 2007, Moore and Benbasat, 1991)
	-----------	Voluntariness	Voluntariness of use	'The degree to which use of the innovation is perceived as being voluntary, or if free will'. When examining the diffusion of innovations, consideration is also given to whether individuals are free to implement personal adoption or rejection decision.	(Moore and Benbasat, 1991, Agarwal and Prasad, 1997, Venkatesh and Davis, 2000, Venkatesh et al., 2003, Hsu et al., 2007, Kautz and Pries-Heje, 1996, Venkatesh and Bala, 2008)

Having described the previous related studies and the development of the theoretical evaluation framework that will be used in second stage of evaluating user perspectives towards the research conceptual model (phase II of the research), the related hypotheses are formulated in order to explore the user intention towards the acceptance of using the proposed 'integrated virtual enterprise utility management' framework as a mean of managing their utility services online. The main hypothesis and related sub- hypothesis can be formulated as follows:

<u>Main H.b:</u> The user overall perceptions towards the new innovation characteristics will positively affect their intention to accept and adopt the innovation.

H.b (1): The user's 'perceived usefulness' (PUSF) of the proposed innovation will positively affect their intention towards acceptance and adoption.

H.b (2): The user's 'perceived ease of use' (PEOU) of the proposed innovation will positively affect their intention towards acceptance and adoption.

H.b (3): The user's perception of the innovation's 'compatibility with [their] prior experience' (CMPE) will positively affect their intention towards acceptance and adoption.

H.b (4): The user's perception of the innovation's 'compatibility with [their] values' (CMPV) will positively affect their intention towards acceptance and adoption.

H.b (5): The 'other use' (OU) experience with technology innovation will positively affect their intention towards acceptance and adoption of the innovation.

H.b (6): The user's perception of the innovation's 'communicability' (CMU) will positively affect their intention towards the acceptance and adoption of the innovation.

H.b (7): The user's perception as regards to the innovation's 'measurability' (MSA) will positively affect their intention towards acceptance and adoption of the innovation.

H.b (8): The more "trialable" (TRI) the innovation is from the user and service perspectives, the more positive the effect on their intention towards acceptance and adoption of the innovation.

3.3.3 Phase III: Effects of the proposed platform on promoting user intentions towards sustainable behaviours

Midden et al. (2007) have shown that individual behaviours and technology innovations are highly interrelated in several aspects and demonstrate different means, which enable building an effective technique that integrates information technology with behavioural related attributes to encourage individual sustainable behaviours. The purpose of this section is to develop the theoretical framework in order to evaluate the impact of the research model on encouraging the user's behavioural intentions towards sustainability in line with the earlier research investigating the role of technology innovation on encouraging individual's to adopt sustainable behaviours, which in most cases had a major influence on individual behavioural related variables such as: attitudes, cognitive, beliefs, and social norms.

The main goal of this theoretical framework is to explore the role of the 'integrated virtual enterprise utility management' model on the promotion of individual behavioural intentions regards pro-environmental sustainability and also with regards to the intentions to use the innovation platform for desired goals of utility resources conservation. Additionally, based on the outcome of the research model approach, recommendations will be provided as a guide to increasing our understanding of an efficient technology innovation paradigm that assists in promoting individual sustainable behaviour intentions. By accomplishing this goal, this thesis can complement previous scholars' research efforts and contribute to the research field on improving individual pro-environmental sustainable behaviours and encouraging natural resource conservation behaviours ((Cook and Berrenberg, 1981); (De Young, 1993); (Dwyer et al., 1993); (Geller, 2002); (Schultz et al., 1995); (Stern, 1992); (Winett and Kagel, 1984)).

3.3.3.1 Development of theoretical measurement model: The technology innovation model effects on individual behavioural intention

As a step toward understanding how technology innovation can be employed to positively affect individual behavioural intentions towards environmental sustainability, this research reviews different previous studies that apply a behavioural measurement framework to explore the role of technology in improving individual behavioural intentions towards sustainability. Notably, a prominent previous theoretical framework adopted the TPB to explore individual behaviour in environmental contexts. The majority of studies have been carried out at the domestic level (Knussen and Yule, 2008, W. Trumbo, 2001). In previous studies, the TPB has been broadly applied in examining different areas of human behavioural activities such as: health (Conner and Sparks, 2005), travel (Bamberg and Schmidt, 2003) and driving behaviour (Marcil et al., 2001).

The TPB has been widely used to examine environmental behaviours and is recognized to be effective in predicting individual behaviour (Oreg and Katz-Gerro, 2006, W. Trumbo, 2001). Studies by Trumbo (2001), Lam (2006) Clark and Finley (2007) were carried out to explore individual intentions to reduce resource consumption in different countries, the common conclusion of which was that TPB with its main measurement constructs was highly effective in predicting individual behavioural intentions. It is observed that TPB were applied to explore a variety of pro-environmental behaviours (Bamberg and Schmidt, 2003, Heath and Gifford, 2002) (De Groot and Steg, 2007, Fielding et al., 2008).

However, to the best knowledge of the author's knowledge, no previous studies have applied the TPB theory (Ajzen, 1985, Ajzen, 1991) in to the specific investigation of the influence of an 'integrated virtual enterprise utility management' on promoting individual behaviours towards environmental sustainability. This study purports that the potential research model's effect on promoting individual behaviours and their intention towards sustainability can be explored using TPB theory. Relevant studies (Laudenslager et al., 2004), (Fielding et al., 2005), support the notion that TPB is an effective theoretical framework in the explanation and prediction of environmental behaviours and largely use it as a theoretical base for investigating behaviour related aspects. Based on the TPB, the best predictor of actual behaviour is the intention to perform that behaviour. The behaviour intention is an indicator of the degree to which individuals are willing to perform such targeted desirable behaviours. Also, according to TPB, individual intentions are influenced by different behavioural intention determinants including: individual attitudes, subjective norms, and perceived behavioural control.

A study by Armitage and Conner (2001) reviewed a large number of relevant studies that used the TPB for investigating both actual and self-reporting behaviour, concluding that TPB was an effective theoretical framework for predicting behaviour with a stronger predictive capability for self-reported than actual behaviour. Most studies in environmental behaviours that use the TPB acknowledge that it is a great predictor of environmental behaviour (Kaiser and Gutscher, 2003, Taylor and Todd, 1997). Another review conducted by Oskamp and Schultz (2005) stated that most relevant studies assert that behavioural intentions are effective and reliable predictors of actual behaviour (Brandon and Lewis, 1999, Egmond et al., 2005). In the research area of investigating pro-environmental behaviour, a study by Davis (2008b) indicates that a large number of previous research focused on exploring environmental behaviours at the individual level. Other literature (Abrahamse et al., 2005) indicates that many researchers also focused on environmental behavioural aspects at a domestic level.

A widely recognized theoretical approach amongst scholars in the exploration of environmental behaviour was the use of social behaviour theories, with prominent use of the theory of planned behaviour as a base model in their investigation (Ajzen, 1985, Ajzen, 1991). As a result, this study will employ dominant practice guidelines (Ajzen, 1991) to formulate the theoretical validation framework and to design the research survey based on the TPB theory, as presented in Figure 3-7.

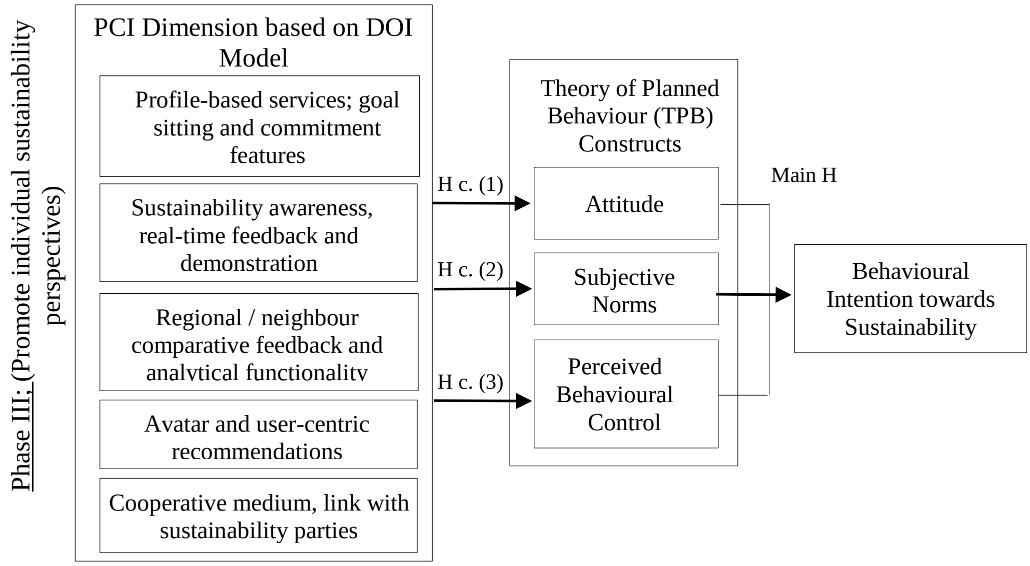

Figure 3-7: Theoretical validation framework to investigate the ‘one stop' technology innovation platform’s influence on individual behavioural intentions towards sustainability

The objective is to examine the extent to which the sustainability related functions will affect the main TPB dependent constructs effecting the outcome measurement of individual behavioural intentions toward sustainability as depicted in Figure 3-7. This study is in-line with recent call for research to raise individual awareness for better positive environmental behaviour (Spence et al., 2009).

Based on the TPB theory, the individual behaviour intention is the main predictor of their actual behaviour. According to TPB, the individual behavioural intention is related to three measurement constructs (as depicted in Figure 3-7). The first measurement construct is the individual’s attitude toward the behaviour, which indicates their overall assessment of the behaviour, according to their estimation of obtained desirable results from adopting such behaviour (Ajzen, 1985, Ajzen, 1991).

The second measurement is based upon an assessment of the subjective norm, which is the extent to which the individual believes that they are under social pressure to perform the behaviour. This is based upon the individual’s perception of the expectation of reference groups that they hold to be important and their motivation to comply with these reference groups.

The final construct is perceived behavioural control (PBC), which is a function of the individual’s perception of how hard it would be to perform the behaviour, and is thus determined by the extent to which they believe they have self-efficacy to perform the behaviour and perceive that they have control over the behaviour. The detailed measurement constructs of the theoretical framework are defined in the following section.

3.3.3.2 Construct operationalisation and measurements framework: Effects on 'Individual behavioural intention' as dependent variables

The theoretical framework for the validation phase includes a preliminary stage to understanding how individual behaviour theories can be exploited to achieve pro-environmental behavioural improvements. This research is aligned with the previous approach that applies a measurement framework underpinned by the TPB (Ajzen, 1985) to explore the effects of the research model on individual behaviour intentions to sustainability. It is to achieve the goal of encourage individual environmental behaviours intentions using persuasive technology. In similar studies, the TPB had been used to study individual behaviour in environmental contexts, where the prominent research explored the behavioural related aspects in local or at an individual level (e.g. Knussen and Yule (2008), and W. Trumbo (2001). For example, Oskamp and Schultz (2005) reviewed previous studies that used TPB theory for environmental behaviour and investigated the factors that affect the relationship between attitudes and behaviours. They concluded that intentions are a reliable predictor of actual behaviour, if both individual attitudes and behaviours are well defined (e.g. Brandon and Lewis (1999), and Egmond et al. (2005). In relation to environmental behaviours, another study utilised the TPB and considered it to be a successful theory to predict environmental behaviour (Kaiser and Gutscher, 2003, Taylor and Todd, 1997). However, the majority of researchers who have applied the TPB have emphasised the individual intention as a major antecedent predictor of actual behaviour. It is considered that behavioural intentions are a main indicator of the extent to which the individuals are willing to act to perform their actual behaviour. According to TPB, the three core constructs that affect behavioural intentions are attitudes, subjective norms, and perceived behavioural control. It was noticeable that the majority of studies focus on using only the TPB theory with its measurement determinants to analyse and predict the individual's intentions with regard to pro-environment behaviour. Furthermore, Ajzen (1991) suggest that by evaluating the effects of individual beliefs on behaviour a better understanding of the different elements of TPB behavioural determinants and how they separately influence the overall behaviour intentions can be gained. This research follows framework guidelines initiated by, for example, Ajzen (1991) in defining the survey measurement constructs based on the TPB.

This process is followed to explore the extent to which the sustainability related functionality integrated in the research model can promote the individual behavioural intention to sustainability. Both effects of the three main TPB determents and on the behavioural intention as a dependent determinant were examined in relation to sustainability behavioural intentions. This study was aligned with the recent need for research to focus on behavioural intention at an individual level to improve environmental behaviour (Spence et al., 2009). Following the creation of measures based on TPB, the researcher operationalised the measurement constructs of the questionnaire, as illustrated in Table 3-5:

Table 3-5: Measurement constructs of integrated virtual enterprise utility management platform ('one-stop' model) influence on Individual sustainability behavioural intention, relevant models, and references

Base Theory	TPB Constructs (Ajzen, 1991)	Definition of Construct	Previous studies in sustainability behavioural
TPB	Attitudes	Attitudes, is "referred to the degree to which an individual has a favourable or an unfavourable evaluation of a given behaviour. For instance, individuals may resist from using the innovation of sustainability-related functions, because they feel that he is not comfortable with the innovation.	(Ajzen, 1991, Sivek, 1987, Brandon and Lewis, 1999, Ramsey and Rickson, 1976, Poortinga et al., 2003, Knussen and Yule, 2008, W. Trumbo, 2001, Spence et al., 2009, Davis, 2008b, Lam, 2006, Clark and Finley, 2007, Bamberg and Schmidt, 2003, Heath and Gifford, 2002, De Groot and Steg, 2007, Fielding et al., 2008, Laudenslager et al., 2004, Fielding et al., 2005, Armitage and Conner, 2001)
	Subjective norms	Subjective norms refer to the perceived social pressure to perform or not to perform a behaviour. It encompasses individual perceptions of the extent to which important others would endorse a given behaviour and individual motivations to comply with this social pressure.	
	Perceived behavioural control	Perceived behavioural control refers the perceived ease or difficulty of engaging in a behaviour also the individual capabilities to perform the behaviour. For instance, the user may not be willing to use the innovation to reduce resource consumption, because they do not feel themselves capable to do such activities within the innovation.	

Having described the previous related studies and TPB theoretical framework, the hypotheses proposed in (phase III) of this research are defined in order to explore the effects of innovative sustainability related functions integrated within the research model on user's behavioural-related dimensions and to promote their overall behavioural intention towards sustainability. The main hypothesis can be formulated as follows:

Main (H.c): The sustainability-related functionality integrated within the proposed research model will promote users' future 'behavioural intention' (BI) towards pro-environmental sustainability.

The main hypothesis is a synthesis of three sub-hypotheses of user behavioural related determinants (derived from TPB theory) expressing individual overall behavioural intentions towards sustainability. In summary, the research theoretical measurement model and hypothesis was formulated to investigate the effects of sustainability related functionality on three independent behavioural-related variables. The independent behavioural-related variables were defined in accordance with TPB theory as: individual attitude (ATT), subjective norms (SBN) and perceived behavioural control (PBC). Thus, the sub-hypotheses Hc. (1), Hc. (2) and Hc. (3) can be formulated as follows:

H.c (1): The integrated sustainability related functions (integrated within the research model) positively affect user's 'attitude' (ATT) towards pro-environmental sustainability.

H.c (2): The sustainability related functions (integrated within the research model) will positively affect user's 'subjective norms' (SBN) in relation to pro-environmental sustainability.

H.c (3): The sustainability related functions (integrated within the research model) will positively affect the 'perceived behavioural control' (PBC) from a user point of view in relation to pro-environmental sustainability.

3.4. Summary

This chapter has integrated the literature review and developed a conceptual model that aims to explain the major determinants of user adoption of the 'integrated virtual enterprise utility management' platform and intelligent eService's delivery approach (or 'one stop' model) to promote individual sustainable behaviour.

In the present study, three research focuses were determined as important in the investigation of user perspectives towards user adoption of technology innovation conceptualised in the research model. These included: user evaluation of task-technology fit, technology acceptance and the model's potential influence on individual behavioural intentions towards sustainability (Figure 3-8).

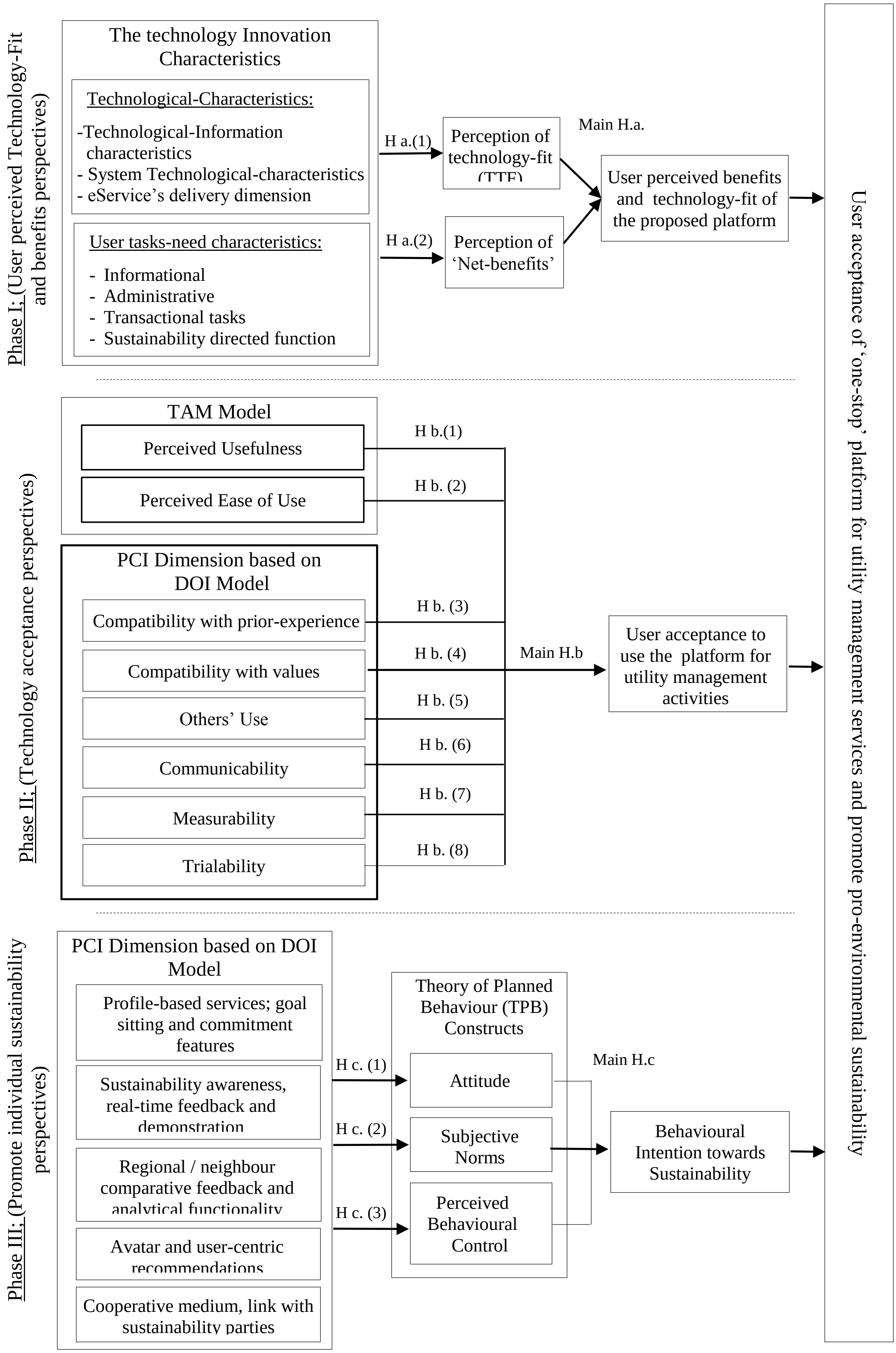

Figure 3-8 illustrates the theoretical evaluation framework with three sequential phases of validating the conceptual research model.

A user perception of ‘task-technology fit’ and perceived benefits are formulated in the theoretical evaluation framework, which is based on TTF theory and the ‘net-benefits’ measurement instruments. Moreover, TAM, DOI, and PCI theories are all employed to predict user intentions to adopt the conceptualised research model. It comprises of four factors of measurement: perceived usefulness, perceived ease of use, user perception of compatibility with prior experiences, values, communicability, measurability, trailability and others’ use. Lastly, the theoretical evaluation model was underpinned with the theory of TPB defined by to investigate the effects of sustainability related functionality associated with the research model on a user’s overall behavioural intention towards sustainability. The final theoretical evaluation framework has defined all relevant relationships between the model constructs in accordance with the research hypotheses that have been formulated to answer the research questions presented earlier in Chapter 1. The following Table 3-6 below, summarises the hypotheses defined in this study, while next chapter will present the research methodology applied to achieve the research objectives and test all hypothesis.

Table 3-6: Summary table of the research hypotheses with related thesis chapters.

<table>
<tr><th colspan="4">Hypotheses statement</th><th>Thesis Chapters</th></tr>
<tr><td colspan="2">Main hypothesis (H.a)</td><td colspan="2">Utility users have a positive opinion regarding the roll-out of ‘a one-stop’ innovation platform for utility management; and, they perceive the model’s benefits and technological fit with their routine tasks of managing utility services online.</td><td rowspan="3">Chapter 2, 3 and 6</td></tr>
<tr><td rowspan="2">Sub hypothesis of (H.a)</td><td>Ha.1</td><td colspan="2">The ‘one-stop’ innovation model influences individual perceptions of task-technology fit and will positively affect user technology innovation adoption</td></tr>
<tr><td>Ha.2</td><td colspan="2">Users value the roll-out of ‘one-stop’ innovation platform for utility management, and they have positive perceptions as to the ‘net-benefits’ to managing utility services online.</td></tr>
<tr><td colspan="2">Main hypothesis (H.b)</td><td colspan="2">Main H.b: The composite user’s perception to the new innovation characteristics will positively affect the intention to accept and adopt the innovation.</td><td rowspan="5">Chapter 2,3 and 7</td></tr>
<tr><td rowspan="4">Sub hypothesis of (H.b)</td><td>Hb.1</td><td rowspan="2">TAM Constructs</td><td>H.b (1): The user’s ‘perceived usefulness’ (PUSF) will positively affects their intention towards the innovation acceptance and adoption.</td></tr>
<tr><td>Hb.2</td><td>H.b (2): The user’s ‘perceived ease of use’ (PEOU) will positively affects their intention towards the innovation acceptance and adoption.</td></tr>
<tr><td>Hb.3</td><td rowspan="2">DOI and PCI Constructs</td><td>H.b (3): The user’s perceived ‘compatibility with prior experience’ (CMPE) will positively affects their intention towards the innovation acceptance and adoption.</td></tr>
<tr><td>Hb.4</td><td>H.b (4): The user’s perceived ‘compatibility with values’ (CMPV) will positively affects their intention towards the innovation acceptance and adoption.</td></tr>
</table>

	Hb.5		H.b (5): The 'other use' (OU) experience with technology innovation will positively affects their intention towards the innovation acceptance and adoption.	
	Hb.6		H.b (6): The user's perceived innovation's 'communicability' (CMU) will positively affects their intention towards the innovation acceptance and adoption.	
	Hb.7		H.b (7): The user's perceived innovation 'measurability' (MSA) will positively affects their intention towards the innovation acceptance and adoption.	
	Hb.8		H.b (8): The more trialable innovation will be valued from the user and service 'trialability' (TRI) will positively affects their intention towards the innovation acceptance and adoption.	
Main hypothesis (H.c)		The 'one-stop' innovation platform will positively influence user behavioural intentions towards sustainability		Chapter 2,3 and 7
Sub hypothesis of (H.c)	Hc.1	Sustainability–related online services effect positively user attitude (Behavioural belief) positively effects user behavioural intention to sustainability		
	Hc.2	Sustainability–related online services effect positively subjective Norms (Normative belief) positively effects user behavioural intentions towards sustainability		
	Hc.3	Sustainability–related online services effect positively perceived behavioural control (Control belief) → user behavioural intentions towards sustainability		

Chapter 4: Research Methodology

Introduction, research design strategy, approach, philosophy, design strategy, time horizone, data collection method, Data analysis methodology

4.1. Introduction

Research has been defined as a "systematic investigation to establish facts or principles or to collect information on a subject" (Wilkes and Krebs, 1991, p.1316). The research process includes investigation of the research domains, formulating research questions and hypotheses, and employing appropriate research methodologies to answer these questions (Nunamaker Jr and Chen, 1990). In general, the research design and methodology of this thesis was defined in order to look into the research phenomena and to enable a systematic conduct of the research process. In the previous chapter 3, a literature review of related fields was conducted to provide a theoretical basis to the proposal of an appropriate conceptual model, along with the formulation of a number of hypothesised relationships, including the definition of the scope of the research and underpinning research questions.

This chapter will present the research methodological design process that will be employed to achieve the research objectives and address the research questions. It describes the development of the empirical research design approach utilised to validate the research conceptual model and to test the associated proposed hypotheses. It also serves to justify the appropriateness of the selected methodology design approach of this study in accordance with the research context and problem under investigation. In relation to this study, the research domain under exploration is the user acceptance of a "one-stop' integrated utility management solution proposed through a conceptual model of an integrated virtual enterprise utility management innovation framework (in the context of Saudi Arabia) and potential of this solution to promote individual intentions towards sustainable behaviour.

This chapter starts by presenting the dominant research paradigms with an overview of the research methodologies, and their advantages and disadvantages in order to build a philosophical basis for the research paradigm that will be employed in this research. It will then explain and rationalise the selected research approach, research strategy, time horizons, questionnaire survey, and data collection method. In the following sections, the research design process will be presented in four major subsequent phases providing the research methodology design that will answer the research questions. Within each phase, the sample design process will be explained together with a justification of the sample method choices. In the last two sections (4.10.1 and 4.10.2) the methodology of the data analysis (including data preparation and the pre-analysis process) will be explained, which also includes the questionnaire instrument validation and reliability assessment. The last section introduces the methodology for the data analysis process, describing the employed analytical techniques in each data analysis stage of this study.

4.2. Research design strategy

According to Burns and Bush (2003, p.120), a research design is “a set of advance decisions that makes up the master plan specifying the methods and procedures for collecting and analysing the needed information”. In general, the early identification of a relevant research design is important for the reason that such a paradigm will establish the definition of the data type, collection method and the sampling techniques (Hair et al., 2003). It serves to support the process of associating the research methodology with the research gap under investigation (Churchill and Iacobucci, 2009, Malhotra, 2010). The types of research paradigm are: exploratory, descriptive, explanatory (analytical) (Gable, 1994, Yin, 2009, Burns and Bush, 2003, Churchill and Iacobucci, 2009, Hair et al., 2003, Aaker et al., 2008) and predictive (Collis and Hussey, 2003). Based on the characteristics of the research paradigm, research context, and the nature of problem, the study will determine the most appropriate design strategy that can help in obtaining results and answer the research questions.

Exploratory research is conducted to present a better understanding of a situation and to guide further research in the problem domain (Malhotra, 2010, Parasuraman, 2007). It is essential to utilise this type of research approach when there are no or limited previous studies on the research problem or the issues under investigation. The information obtained in this type of research is considered as input information and it is a foundational basis for additional research (Churchill and Iacobucci, 2009, Malhotra, 2010). It is classified as a flexible, unstructured, and qualitative research approach (Aaker et al., 2008, Burns and Bush, 2003). During exploratory research, researchers try to develop hypotheses about what is going on in a specific problem situation, which is not designed to provide final answers or decisions to the research problem. Normally, the objective is to search for existing patterns, ideas or hypotheses, instead of testing a hypothesis.

Descriptive research is significantly different from exploratory research in its objectives. According to Robson (2002, p.59), descriptive research is typically used when the objective of the research is "to portray an accurate profile of persons, events or situations". It can statistically describe patterns or trends of a situation and assist in producing data that enables the finding of relationships between research variables (Aaker et al., 2008), without identifying the causal relationship between these variables. It is also used by the researcher to describe certain behaviour as it happened in the real situation. In contrast to explanatory research, a descriptive research is deemed to be a more pre-planned, structured method that uses a large data sample of the population (Churchill and Iacobucci, 2009, Hair et al., 2003, Malhotra, 2010). However, descriptive research designs are most commonly identified as quantitative research by their nature (Burns and Bush, 2003, Churchill and Iacobucci, 2009, Hair et al., 2003, Parasuraman, 2007).

Typically, descriptive research is used as step toward adopting a further research approach instead of being a method of obtaining final research findings by itself. For example, in much research, it was applied as a step prior to conducting explanatory research, which obtained information in order to have more insight into the phenomena under study, identifying the data collection based on preliminary data collection obtained from the descriptive study.

Explanatory (analytical) research is typically used as a continuation of descriptive studies for further analysis/exploration of a certain situation (Collis and Hussey, 2003). The aim of explanatory studies is to answer the why or how questions. Explanatory research is conducted to achieve beyond what exploratory and descriptive research have provided. It is generally used to determine the actual cause behind the phenomenon that occurred. Explanatory research also attempts to incorporate existing theories in order to add to principles or to predict some phenomena. This is accomplished by using the scientific method to obtain base evidence for extending existing ideas or to create new ones. It is also suitable for providing the required evidence for the identification of the causal relationships between research variables (Parasuraman, 2007).

Predictive research goes even further beyond the objectives of explanatory research. Where explanatory research aims to explain the phenomena and determine what is happening in a certain situation, predictive research aims to foresee the possibility of a situation happening. Predictive research uses analytical methods to predict phenomena for the sake of generalisation based on a definition of general relationships and research hypotheses. Consequently, the research finding of a certain study will be appropriate for application in other similar situations (Collis and Hussey, 2003).

Churchill and Iacobucci (2009), and Burns and Bush (2003) argue that different research designs might be employed in different phases of research. In some situations, a study can start by conducting exploratory or descriptive research as a way of providing more understanding into the research phenomena and to provide guidance for the following explanatory or causal studies.

In line with this approach, this research will employ different research designs to answer the research questions. In selecting a research design, this study draws upon a prior theoretical framework taken from the literature review. It thus cannot be considered exploratory. Also, due to the research context and nature of the problem, the research design was conducted in two different phases. Firstly, descriptive, in order to provide insightful analytic understanding into the phenomena and, secondly, explanatory to test the hypotheses (Sekaran and Roger, 2013). In this matter, a descriptive research design can be relevantly employed to gain more insight into the phenomenon as observed by individuals (Yin, 2009). Furthermore, it can provide a means to understand different individual perspectives towards the phenomenon and to attain a multi-facetted, comprehensive description or conceptualization (Cavaye, 1996).

By referring to the context of the research model presented in Chapters 2 and 3, this research may be considered as a descriptive and explanatory research (Saunders et al., 2008). It was concluded by the author that a descriptive research design was most appropriate to be employed at the initial phase of the research due to the fact that there is a lack of knowledge about the research situation in relation to Internet-user technology adoption of utilities management, despite the existence of numerous research studies on the topic of user technology acceptance and related theories.

In this research, descriptive research design is essential during the initial phase of the research in order to gain an increased understanding of the research phenomena and to explore Internet-user perceptions of new technology innovation acceptance in a utility management context. Based on the fact that electronic services in Saudi Arabia have been used since 2002, the electronic services for utility management necessitated an exploration into increased technology adoption. However, there is no empirical research to assist the electronic services providers and decision makers to gain insightful understanding of the existing situation and to help them observe major determinants that describe the user acceptance of electronic services of utilities management in a Saudi context. Thus, a descriptive research is essential to obtain the necessary information about the research situation in its context and to help realise the important factors that affect user technology adoption. In addition to the literature review of related topics, the descriptive research can prove an effective instrument in obtaining the needed information. A questionnaire is considered appropriate for this study to provide the required descriptive research information obtained from potential information sources (Churchill and Iacobucci, 2009). Generally, the surveyed respondents can express their thoughts, beliefs, experiences, and attitudes of the new technology innovation and research model. The outcome of the descriptive study considered is an important step towards conducting the subsequent phase of the research. The obtained results will provide an input for the further explanatory research and will help to develop the scales and the questionnaire instrument.

An explanatory research is conducted during the next research phase. However, by referring to the research model as presented in Chapter 3, it is notable that this study will employ a sequence of research phases starting with a descriptive and then followed by an explanatory research approach. The choice of explanatory research was identified as an appropriate research design since the model presents the relationships between variables that affect each other, and it is essential to investigate and explain the variables displaying the greatest effect, influencing the adoption of the model under study. The focus was on explaining the influence of new technology innovations on each of the model's variables and to test the hypothesis using statistical analysis. The purpose is to describe the strength and importance of the influence of each of the model's variables on user technology adoption. However, acquiring information from a sample population is essential since it serves to investigate the users' new technology adoption behaviour. Two basic methods are commonly used for data collection in relation to descriptive and explanatory research approaches, namely: cross-sectional and longitudinal. The cross-sectional technique was the most appropriate for application in this study due to the research time constraints and the scope of the work to be undertaken, which will ignore trends across the lifespan.

4.3. Research approach

Before defining the details of the methodological approach that will be undertaken in this research, a detailed description of different design dimensions of the research process will be presented. According to Saunders et al. (2008), a research design process can be understood as layered dimensions that include research philosophy, approach, strategy, choices, time horizons, as well as the different techniques and procedures that will be applied. It is also important to outline the dimensions of this research process, as defined by Saunders et al. (2008) and depicted in Figure 4-1, in order to determine the details of the research design employed in relation to the research philosophy, approach, strategy, choices, time horizons and data collection method. The following subsections will explain the research design process with a more in depth description given to the five layered dimensions, linking them to the research methodology.

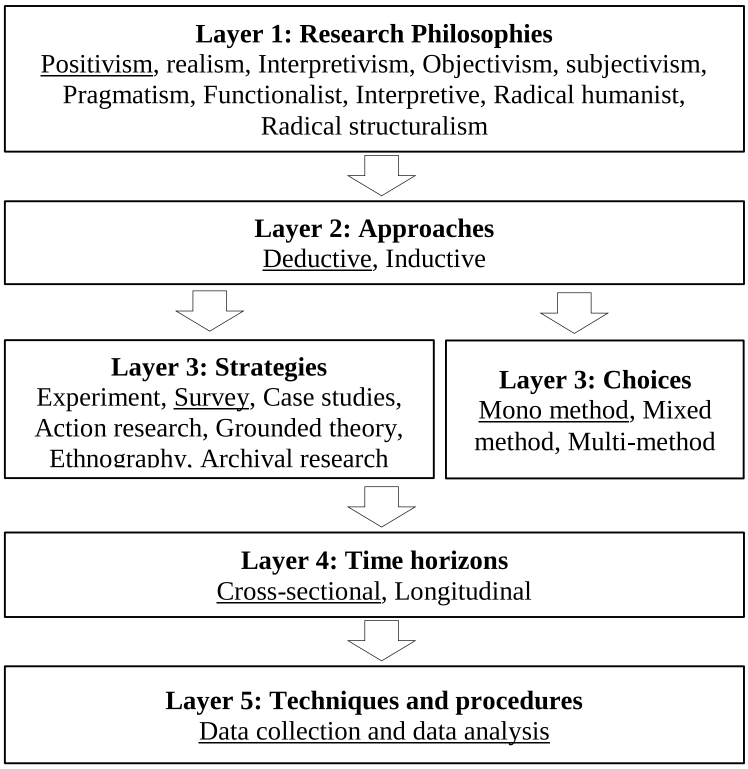

Figure 4-1: The five layered dimensions of the research design process as defined by Saunders et al. (2008).

4.4. Research philosophy

The first layer of the research design process is the identification of the appropriate research philosophy. Research philosophy can be described as the development of the underlying background and knowledge of the nature of the research (Saunders et al., 2008). In addition, research philosophy can be defined utilising a descriptive research paradigm approach. Cohen et al. (2000) describe the research paradigm as the comprehensive worldview, which includes a whole framework of beliefs, values and methods alongside an understanding of the related theories and practices that will be used in the research. In other words, it can be described as a certain procedure, which includes different actions that enable a researcher to make a connection between the objectives of the research and the questions under study. Gliner et al. (2000, p.17) define the research paradigm as “a way of thinking about and conducting research”. They also stated that a paradigm “is not strictly a methodology, but more of a philosophy that guides how the research is to be conducted”. It is essential for the researcher to identify the research position in relation to philosophical research paradigm in order to understand and design appropriate research methods. To gain more insight into the reality of the situation, there are three type of research paradigms that can be adopted: positivist, interpretivist and realist views. The choice of paradigm leads to different means of obtaining results and describing the problem under study. In this research, in order to investigate the phenomena concerned in the domain under study (Chapters 2 and 3), the paradigms that are broadly recognised in information systems research will be adopted. In the information system research domain, positivism and interpretivism are considered to be the valid epistemologies when conducting research (Myers, 2013, Clarke, 2000).

The positivist paradigm relies on the idea that reality can be observed directly and described objectively. The epistemological view of positivism is based on the assumption that phenomena can be observed and measured by objective methods (May, 2011). Positivists make use of rational thought to obtain knowledge about the external world, which is always assumed to be objective. In this type of philosophical approach, a researcher presents their evaluation of the phenomena by employing objective rather than subjective means (Cooper and Schindler, 2014) The positivist is attempting to discover underlying laws and causal relationships using an objective analysis of the facts under investigation. The researcher is placed in an independent position to the phenomena, and is assumed not to affect or be affected by the problem under study, in which the researcher's beliefs bear no value on the results of the research.

In the positivist philosophical approach, researchers formulate a hypothesis to solve the problem of interest, which is subjected to empirical evaluation using quantitative methods (Buttery, 1998). It is typically associated with empirical studies and observation to acquire data for quantitative research (Easterby-Smith, 2006). This method provides an objective and clear interpretation of the reality (Guba and Lincoln, 1994).

In contrast to the positivist paradigm, interpretivism relies on people's understanding of a worldview from their own frame of reference (Collis and Hussey, 2014). The emphasis in this paradigm is on the subjective state of reality, which relies on interpreting the meanings of the phenomena subjectively (May, 2011). May (2011) explains that an interpretative paradigm relies on individual points of view and interpretations of the reality of the problem. Thus, the focus under this philosophical approach is on meaning rather than a measurement of the phenomena by objective methods. Basically, a researcher conducting interpretative research employs an inductive approach in which theories are developed as an outcome of data analysis results. The interpretivists participate in defining the meaning and become a part of the research problem and try to be knowledgeable with regards to what happening (Easterby-Smith, 2002, Saunders et al., 2008).

There are major differences between those two paradigms briefly described above. According to Peter and Olson (1983), a positivist will try to find out the nature of the reality of a situation while, in contrast, interpretivists create many realities. The positivist paradigm is focused on "verifying theories with the collected data, whilst interpretivism is largely concerned with building theories from the collected data" (Burrell and Morgan, 1979). The main distinctions between the two paradigms are presented in Table 4-1.

According to the positivist paradigm, the researcher assumes that reality can be measured by objective methods and, thus, employs a quantitative data collection method (i.e. Survey questionnaire) with a large sample size. The researcher distances himself from the research problem during the study to avoid affecting the results (Collis and Hussey, 2014). In contrast, interpretivists assume that reality is subjective, and can be described and interpreted meaningfully in subjective manner. Thus, the researcher according to this paradigm relies on a qualitative data collection method in their research (i.e. interviews, ethnography, case studies etc.)(May, 2011, Collis and Hussey, 2014, Maanen, 1983). The researcher is considered to participate in the research problem and is, therefore, involved in the subjective reality.

Table 4-1: The differences between positivistic and interpretative paradigms

Meta-theoretical Assumptions	Positivism	Interpretivism
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's lived experience.
Research Object	Research object has inherent qualities that exist independently of the researcher.	Research object is interpreted in light of the meaningful structure of a person's (researchers) lived experience.
Method	Statistics, content analysis.	Hermeneutics, phenomenology etc.
Theory of Truth	Correspondence theory of truth: One-to-one mapping between research statements and reality.	Truth as intentional fulfilment: Interpretations of research object match lived experience of object.
Validity	Certainty: Data truly measures reality.	Defensible knowledge claims.
Reliability	Replicability: Research results can be reproduced.	Interpretive awareness: Researchers recognize and address implications of their subjectivity.

Making a selection of an appropriate research paradigm is not an easy task. According to Saunders et al. (2008), different issues need to be considered in the selection process including: ontological assumptions, beliefs, and methods for investigating the reality, nature of the research questions, data collection methods and the viewpoint for conducting the research. This research methodology considers these issues during the selection process. The following section will present the research philosophy in detail, justifying the process of selecting the research paradigm.

According to Myers (2013) and Clarke (2000) the dominant epistemological approaches applied in information system research and particularly research in the electronic services business domain are the positivist and interpretivist paradigms. Critical research is the least common in information system research (Myers, 2009). The literature review reveals that the majority of information systems research falls under a positivist research philosophy paradigm (Mingers, 2003, Nandhakumar and Jones, 1997, Walsham, 1995). This is supported by Warfield (2005).The capabilities provided by the positivist perspectives, such as paying a degree of attention to the problem detail, accuracy and comprehensiveness, makes it relevant to this research. Applying such a paradigm can help this study to produce results that are reasonable, sufficient and open to objective evaluation based on accepted standards. In addition, Saunders et al. (2008) stated that the positivist paradigm is advisable since it can provide an economical means of data collection, more clear theoretical-oriented research, easily comparable data and researchers have adequate control over the research process.

In this research study, user adoption of new technology innovation and the associated electronic services in the utility domain will be researched from a positivist perspective because it is consistent with the context of the research problem and nature of the topic. The nature of the research domain, problems and research questions, lend to the categorisation of this research as positivist. The intention of this research is to develop a new technology adoption model and to study its influence on individual intentions towards sustainable behaviours as well as obtain a current profile of internet users together with an investigation into the main variables affecting user acceptance of electronic services in a utilities management context (Chapters 1 and 3). As described in Chapter 3, the hypotheses were developed in accordance with research work in related studies. The survey instruments will be developed by drawing on the input of prior research, providing a data collection method that will be used to test the hypotheses. This technique allows for the selection of samples that represent the Internet and utilities users' characteristics in order to answer the research questions stated in Chapters 1 and 3 for which a survey is the most appropriate method. Therefore, this research is classified as positivist rather than interpretivist in nature since it aims to investigate the current situation regarding the user acceptance of new technology innovation and utilities electronic adoption in Saudi Arabia.

It is also important for the researcher to have acquired some substantial prior understanding regarding the reality of the research problem and the way in which that reality may be grasped within the limits allowed by the paradigm as this will guide the entire research process (Collis and Hussey, 2014). It is also widely recognised that researchers employ a single paradigm in their research and remain using it over the course of their studies (Burrell and Morgan, 1979). According to Kuhn (2012), if the research paradigm is specified, it is recommended for the researcher to stick to that paradigm. Thus, this study will retain the employment of a positivist paradigm throughout the research process.

The selection of an appropriate research approach will be discussed in next section. Concluding from previous Table 4-1, a positivist paradigm is normally conducted using a deductive approach, whereas an interpretivist paradigm is typically related to an inductive approach. Consequently, both approaches will be explained in detail in the following section.

4.5. Research approach

The second layer of the research process aims to identify the research approach of the study. There are two types of approaches, defined as deductive and inductive, that a researcher should choose from before conducting their research. The main distinction between these approaches can be regarded as follows. A deductive approach is applied when the aim of the research is to build a theory and formulate hypotheses, and a related research strategy is subsequently defined in order to examine these hypotheses. In contrast, inductive approach is used to produce a theory from the research finding results.

Drawn from the information system research domain, numerous theories from different research areas were employed to provide a basis for studying the relationship between technological aspects and user social factors, such as their attitude, belief and behavioural intentions. Since these theories are considered as a basis for most user technology acceptance theories, it is rational to employ these theories as a theoretical basis for the development of the research model. Accordingly, a deductive approach was chosen based on the nature of the research problem and will be used to achieve the research objectives. According to Brotherton (2008, p. 17-18), a deductive approach includes different stages: i) identification of the problem concept, ii) production of the theoretical framework, ii) definition of the hypotheses, iv) formulation of the constructs, concepts and operational definitions, v) design of the research, vi) collection of the data, vii) analysis, interpretation of the data and testing the research hypothesis.

In this study, the various steps of deductive research will be followed to obtain the findings. The literature review identified the problem and relevant concepts and the model of user technology adoption in a utility management context was presented in Chapters 2 and 3.

The associations between the concepts were identified and then the research hypotheses were produced, including their precise definitions. A formulation of the constructs, concepts, and operationalisation of the definition were then provided (Chapter 3). This was followed by a design for the research methodology and data collection method (Chapter 4). In the last stage, the hypotheses will be tested using statistical data analysis methods, which include descriptive analysis, Pearson correlation, factor analysis and correlation and multiple regression analysis (Chapter 6 and 7).

Two data collection methods are commonly used in the research field, namely, qualitative and quantitative. The inductive approach is associated with the qualitative data collection method, which in contrast to the deductive approach is always associated with quantitative methods (Maanen, 1983).

Different research approaches are chosen based on their suitability with regards to the research objectives. Thus, the decision of selecting a research method for a specific piece of research mainly depends on the assessment of: i) the method's capacity to achieve the research objectives and to answer the research questions, and ii) its suitability with regards to the necessary resources, time, skills and information access (Punch, 2005). In this research, a quantitative approach was considered to be appropriate for the accomplishment of the research objectives. The decision is based on the conclusion that quantitative methods are broadly applied in the information system research domain (Himma and Tavani, 2008, p 597). By using the quantitative method, the findings obtained represented by objective measurement (numbers), allowed for interpretation of the values in order to explain them and then test the theoretical relationship between the concepts.

In addition, the data analysis using numbers in this method provided solid evidence in the form of the obtained findings with a description regarding the nature of the problem situation. Furthermore, it provided the researcher a more control regarding the analysis of the observed data using statistical software since the data collected were represented numerically.

In summary, in order to achieve the research objectives and answer the research questions, the study employs the quantitative approach as the most appropriate data collection method. The underlying reason for choosing this method relies on the knowledge obtained from the literature review, that in the positivist philosophical approach, a researchers formulate a hypothesis to solve the problem of interest, which is subjected to empirical evaluation using quantitative methods (Buttery, 1998). It is typically associated with empirical studies and observation to acquire data for quantitative research (Easterby-Smith, 2006). This method provides an objective and clear interpretation of the reality (Guba and Lincoln, 1994). This can serve the research objectives of achieving more understanding into the nature of reality and provide adequate answers to the research questions.

4.6. Selection of the research design strategy

According to Saunders et al. (2008) the research strategies are survey, case study, experiment, grounded theory, action research and ethnography. In information system research, a survey is the most common research strategy applied by previous literature (Karanja and Zaveri, 2013, Mohan and Ahlemann, 2013). A comprehensive literature review of research methodologies and design strategies in the information system research field conducted by Palvia et al. (2003) stated that a survey is the most dominant design strategy in this field. The survey is a technique that is broadly used to collect information about people in a sample population (Dillon, 2004). It is considered economic, structured and a practical method of collecting large amounts of data from a large sample size of population (Hair et al., 2003). It is a reliable method that enables data collection that can be analysed, compared statistically and used as a basis for finding generalisations (Saunders et al., 2008).

In this study, the main objective is to investigate the individual perspectives towards the proposed “one-stop” integrated utility management platform and their intentions to use the innovation, as well as their evaluation of the platform’s potential influence on their behavioural intentions towards sustainable behaviour. The scope of the research work involves the need for collecting a large amount of information about individual opinions, views, beliefs and expectation towards the innovation framework conceptualised in the research model. In line with analytical method requirements that will be applied in the data analysis phase of this research, a survey will be conducted to obtain enough data from the sample population, with a sample size of 1193. Based on the nature of the research problem, research questions and purpose, it is deemed essential that the chosen research strategy should support the procurement of a large number of participants’ opinions. Thus, the survey instrument is the most appropriate data collection method for this study.

4.7. Time horizons

Time is an important aspect of any research design methodology, thus defining a study time horizon type is an essential step prior to the selection of a data collection method for the research. There are two types of time horizons: i) cross-sectional, where a researcher studying a particular phenomenon at a particular time collects cross-sectional data and a snapshot of a sample of a population are obtained at a single point in time; and, in contrast, ii) longitudinal studies are when the research takes place over time, with two or more repeated measurements of the same sample population over a period of time (Churchill and Iacobucci, 2009).

A longitudinal data collection method can be seen as more informative than cross-sectional strategy, The key negative aspects of using this approach is that it is more time and financial consuming to conduct research than with the cross-sectional strategy (Creswell, 2013). Time consideration is, therefore, a key factor in the decision process as regards time horizon type selection. In this case, the researcher considers the cross-sectional approach the most feasible strategy for obtaining the research results taking into account the time constraints of this study.

4.8. Data collection method

According to Phillips (1971), some previous researchers adopted a quantitative approach that employs objective measures to test the phenomena, while others used a qualitative approach to explore the condition of the problem over a period of time. The natures of the research topic and research questions to be answered all need to be considered when identifying the appropriate data collection method. The ultimate intention is to obtain suitable data and information that is reliable, valid and appropriate, all in accordance with the research study (Selltiz et al., 1976).

According to Saunders et al. (2008), there are three types of data collection method that are dominantly used in a survey strategy, namely: questionnaire, structured interviews and structured observations. The selection of a suitable data collection method for a certain study mainly depends on its suitability for gathering data that are appropriate for answering the study research questions (Abernethy et al., 1999). In most dominant studies that employ a survey strategy in their research, a questionnaire is adopted as the main method of collecting data (Saunders et al., 2008).

Saunders et al. (2008) also stated that the greatest potential use of questionnaires is when they are employed alongside a survey strategy (Saunders et al., 2008). The questionnaire is a data collection method that is best suited for explanatory and descriptive research (Saunders et al., 2008). It is also the most economical and practical method for gathering different types of information about individuals (Emory, 1980). It is considered a useful formal method for obtaining data about individual information such as their opinions, expectations, preferences, and behaviour.

As stated earlier, the design strategy of this research falls into descriptive and explanatory categories. The development of a theoretical framework for testing the research model was mainly adapted from related theories in the relevant literature, including: task technology fit, technology acceptance and behavioural theories. The measurement determinants were also adopted from these related theories found in the literature. In addition, other validated and reliable measurement constructs in previous studies were adopted insofar as they concerned individual attitudes, beliefs, and behavioural intentions towards both technology adoption and sustainable behaviour. According to the research question and nature of the measurement constructs, it was identified that a questionnaire is the most suited data collection method. According to Hair et al. (2003), questions about individual opinions, attitudes and beliefs are the most appropriate for collation using a questionnaire.

In line with the research objectives, the nature of the research questions, and the requirement that this study be conducted in an economic way, gathering a large sample size to investigate the user opinions about the new technology innovation model, it is feasible to choose the questionnaire as the data collection method of this study. This research approach is mainly applied in similar research areas and in quantitative research in particular (Palvia et al., 2004, Chen and Hirschheim, 2004).

In summary, in the previous sections, the different layers of the research philosophical approach were highlighted linking the selected approach for each layer. In conclusion, this research can be labelled as a deductive study that uses a survey strategy with a cross-sectional questionnaire to collect the data from the sample population. The following sections will describe in detail the study design with more focus on the research design phases of this study. This will be followed by a methodology of the data analysis and choice of analytical methods applied to obtain the results.

4.9. Research methodology design

This section aims to highlight the research methodology design that will be used in this study. A research design methodology can be described as the overall logical plan made by a sequence of decisions that can define the strategy that a researcher will follow to answer the research questions and test related hypotheses. According to Gill and Johnson (1997: p.39), a research methodology design can be defined as "a blueprint that enables the researcher to structure a research problem in such a way that the outcome is the production of valid, objective and replicable answers.". further, it can be described as "a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions about these questions." (Yin, 2003: p.20). It can be seen as a set of guidelines rationally chosen in order to obtain valid research results (Cavana et al., 2001). The research design will provide the researcher with guidelines that will be used for directing the research process throughout the study. It can also assist the researcher in a situation where they need to formulate initial research questions in the face of lacking evidence or enough information about the research problem. However, different research designs are considered appropriate dependent on the research situation. The best research designs are those that acquire the most relevant information about the research problem and gather the most suitable data in order to deal with a research problem properly.

In relation to research designs, Sekaran and Roger (2013) describe three types of research study (i.e. descriptive, exploratory and explanatory), as described in section 4.2. It was argued that a descriptive research is conducted as a means to describing an element of factors in relation to the research problem. Explanatory research is used to test the hypothesis of interest in order to explain the nature of relationships, association between variables or the interdependencies between them.

As stated in the previous section 4.2, the design of this research was identified as descriptive, explanatory, and predictive in accordance with the nature of the research. The research design will include a descriptive study in its initial phase to describe the user perception towards the research problem and to ascertain and understanding of the characteristics of each variable of interest to the study. The other part includes explanatory research in order to test a hypothesis of user technology acceptance and the expected effects of the research framework on individual sustainability behaviour with a view to developing a model that can contribute to technology adoption and to promote the encouragement effectiveness of individual's sustainability behaviour in a utility management context. To the best of the researcher's knowledge, there exists no prior research in this area. Thus, the research design of this study tries to benefit from related research design in the relevant field of technology adoption studies in e-society (namely, e-government, e-commerce and e-banking) and other studies aiming at promoting individual sustainability behaviour.

A research design on a positivist stance includes a selection of the research strategy, measurement instruments, data collection methods and data analysis to conclude research findings (Cavana et al., 2001). The deductive approach chosen in this study, make the quantitative the most appropriate data collection method for gathering necessary data that will be used to achieve research objectives. As described in section 4.5, the inductive approach is associated with the qualitative data collection method, which in contrast to the deductive approach is always associated with quantitative methods (Maanen, 1983). It will be employed to gather the relevant data required to test the research hypothesis and to explain the relationship among research model variables (Straub et al., 2005, Bélanger and Carter, 2008, Gefen et al., 2002, Lee et al., 2005, Warkentin et al., 2002, Moon and Kim, 2001). Additionally, it shall be adopted in order to provide an increased understanding regards aspects that affect user technology adoption of electronic services in utility management. It also provided information about technology innovation characteristics that have influence on individual sustainability behaviour.

In this research, a multi-stage design of the research process was chosen to tackle the research problem and answer the research questions. According to Creswell (2013), the stages of the research process is a set of "sequential procedures, which the researcher seeks to elaborate on or expand the findings of one method with another method". It is essential to define the research design methodology from an early stage in a proper way in order to provide guidance for the following research steps. The intended research design process of this study will be conducted in order to achieve the objectives of the research by identifying the research problem, research methods, and data analysis techniques.

Furthermore, a sequential "stages of research design approach" was identified to be appropriate for answering the research question. The research was structured in four stages: a theoretical stage and three other empirical stages as depicted in Figure 4-2 with their order in logical sequence.

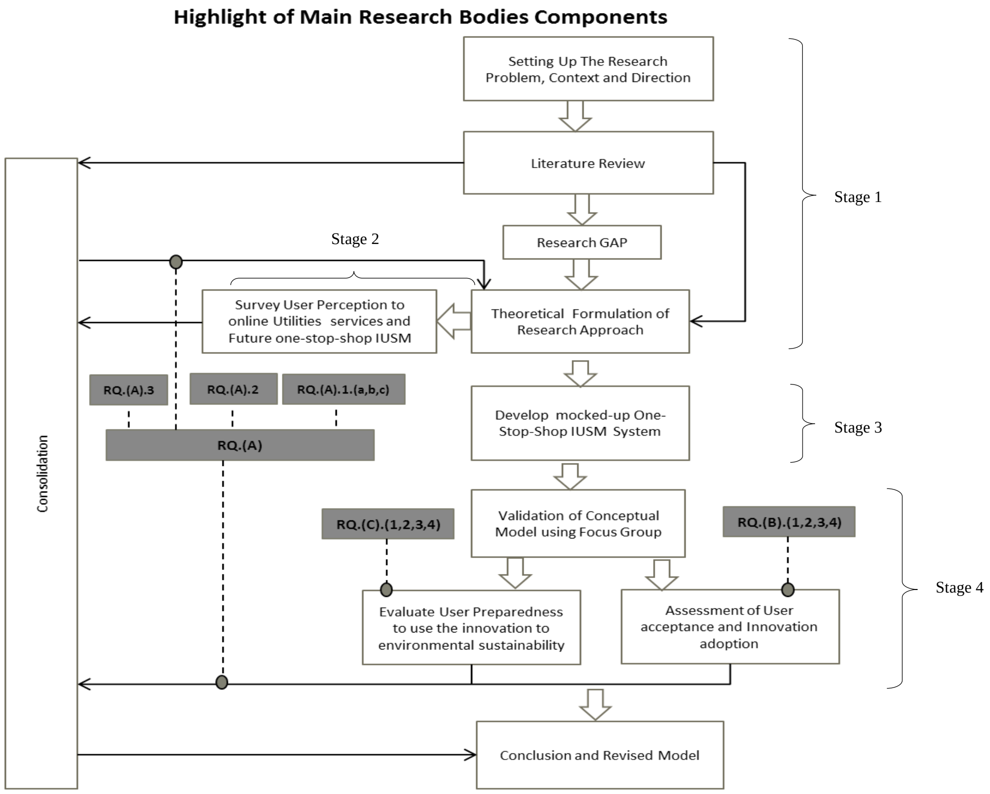

Figure 4-2 Logical description of the flow of the research design process used in this research (Source: Author)

As presented in Figure 4-2, the *initial stage* was devoted to defining the research problem, conceptual model, developing a theoretical validation framework and the research questions with a formulation of the related hypothesis of the study as explained in detail in Chapter 3.

This research was undertaken in the context of technology adoption and the use of technology to enable the encouragement of individual sustainable behaviour. The emphasis is on the literature review with regards to the concepts, principles and major factors affecting user technology adoption and technology influence on individual behavioural intentions towards sustainability as well as the search for relevant theories or models that will be appropriate to the objective of this study. In addition, this phase surveys the existing literature on data analysis and analytical techniques that will be feasible for use in the data analysis phase. This stage of research design initiates the research by reviewing and analysing related literature. The literature review was conducted in order to provide an increased understanding of the research topic and to support a process of conceptualising the essential related research areas of user task technology fit, technology adoption, dimensions of behaviour and individual sustainability issues as well as evaluating different aspects in relation to existing studies in several research domains. For example, in order to identify the relevant dimensions of user task technology-fit, a literature review of the relevant information system research field in different domains of application was utilised to conclude the appropriate factors and measurement constructs that will support the development of the theoretical framework of this study. This stage of the research design is critical to identify the major related aspects of the research topic and to determine the main variables that have an impact on the research problem. The findings of the literature review are also used in developing the data collection method and defining the measurement constructs of the questionnaire instrument.

The *second stage* is considered as the empirical part of the research design, which was conducted in a Saudi Arabian, Internet-user, utility management context. This stage emphasised an empirical investigation of Internet-user's perceptions of task-technology fit, new technology innovation adoption, barriers, trends and difficulties for both existing and future technology innovation as well as an electronic service delivery approach, using a quantitative questionnaire survey instrument to explore the user perception of the relationship between the technology innovation characteristics and their satisfaction. In this stage, Internet users were involved in order to build a consensus on the contents of the research model along with its associated variables. As a result of this stage, the general model of user new technology adoption to promote sustainable behaviour will be developed using an empirical investigation into the research problem and find its basis in the main variables that were obtained from an extensive literature review of related studies and theories in the same field. The model was also revised according to the findings of the results obtained at this stage to represent the user perspectives in the final research model.

In the *third stage* of this research, a development of a mocked-up prototype system is implemented as a further step to an empirical validation of the research model of the study. The role of the mocked-up system is to enable the researcher to present the research concepts alongside the related concepts regards the intended users and to conduct empirically a validation survey (through a platform demonstration and functionality exploration sessions) with an end to investigating the user evaluations of the different concepts of the research model, to meet the aim of the last phase of this study.

The aims of the *fourth stage* are to analytically validate the user perspective towards the new technology innovation as formulated in the research model and to predict their willingness to adopt the framework of the proposed technology innovation as well as verify the user evaluation of the validity of the proposed model on affecting individual sustainable behaviour.

As presented in Figure 4-2, the logical sequences of the research design process of this study shows those aspects that the literature review considered as activities occurring alongside other research stages. In addition to the administrative process that has been continued until the last stage of research design process, the research design process is structured into several phases according to their logical sequence, the detail of each of the four stages is described in the following sections.

4.9.1. Stage one: (Literature) Theoretical development of the adoption model

The first stage of the research design methodology is defined as a literature review phase, which has been outlined as part of the research process of designing the methodology. It includes the initial literature review of various aspects in relation to the research problem that might provide insightful understanding into the research problem. In accordance with the initial literature findings, a formulation of the main and sub-research questions of the research were defined.

Based on the nature of the research problem and the requirements of each of the research stages, the literature review was recruited as a continuous task to be carried out alongside the research process in its different stages.

After acquiring the conclusion from the initial literature review, a more extensive review of the related literature was conducted in order to build a basic background knowledge of user perceptions to task-technology-fit, technology acceptance, electronic services adoption, the role of technology innovation on promoting individual sustainable behaviour and towards sustainable resource consumption in particular. Moreover, this stage includes a review of the all theories pertaining to the research topic of task-technology fit, technology adoption and individual behaviour intentions in order to provide a theoretical basis for the conceptual framework that will be used in this research to validate the model. The literature review methodology applied in the previous chapters was mainly designed in order to formulate the research questions, the conceptual model as well as to provide other related information pertaining to subsequent stages of the research process. The research design methodology that is used in this study to guide the literature review process during the development of the conceptual model is presented in Figure 4-3.

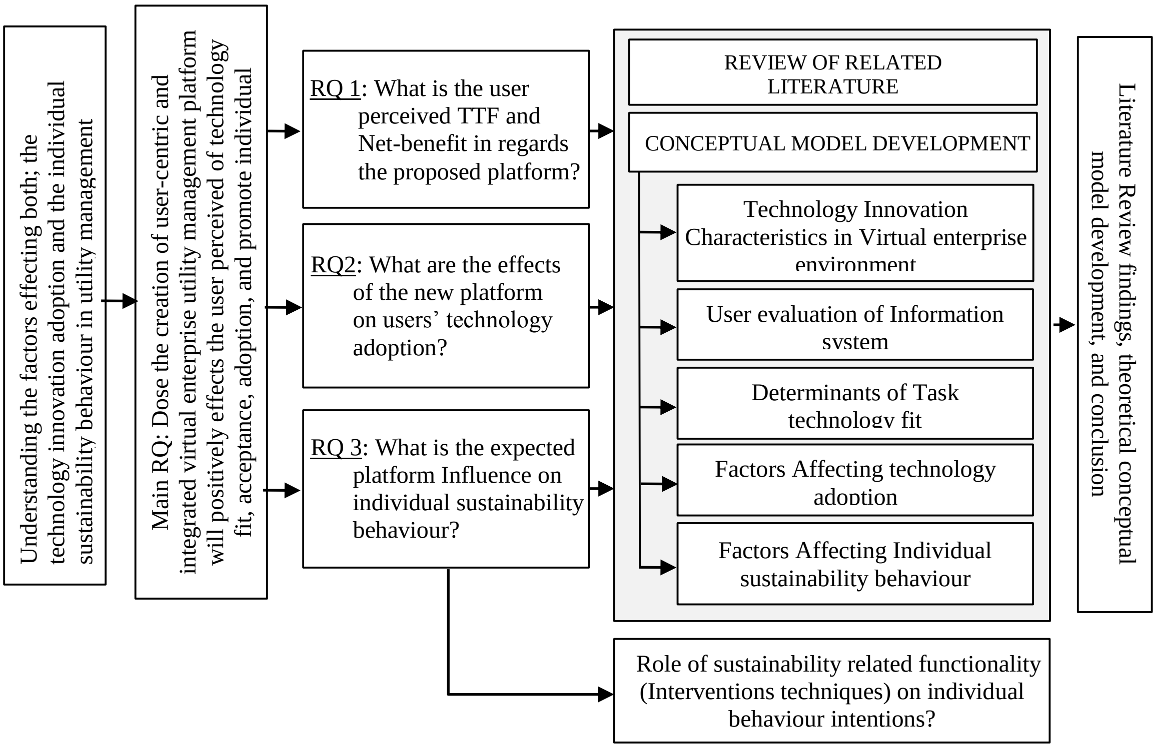

Figure 4-3: The development process of the research conceptual framework

In the literature review design methodology, a review of different broad categories was designed to answer certain facets of the research questions, including the following:

1. Technology innovation characteristics in an integrated virtual enterprise environment (McKinney and Yoon, 2002, Yu et al., 2004, Allan and Wolf Jr, 1978, Boz and Akbay, 2005, Carter, 1998, Davis, 1989, Jacobsen, 1998, Martins et al., 2004, Pagani, 2006, Yates, 2001).
2. The user perception of information system values or the net-benefit outcomes (McKinney and Yoon, 2002, Yu et al., 2004, Gronroos, 2000, Ulaga and Eggert, 2005, Igbaria and Tan, 1997, Qian and Bock, 2005, Wu and Wang, 2006, Delone, 2003, Petter et al., 2012, Petter et al., 2008, Scott et al., 2011, Christopher G, 2005).
3. The user evaluation of innovation characteristics and task-technology fit (Marcolin et al., 2000, Goodhue and Thompson, 1995, McCarthy, 2002a, Zigurs et al., 1999, Murthy and Kerr, 2000, Shirani et al., 1999, Dishaw and Strong, 1998a, McCarthy, 2002b, Chen et al., 2006, Goodhue et al., 1997, Zigurs and Buckland, 1998).
4. Factors that affect user acceptance of technology innovation and electronic services adoption in the similar field of user interaction with online business agencies (This field is similar to an electronic services of utilities management context.) (Davis, 1985,

Shih, 2004, Yu et al., 2005, Bauer et al., 2005, Muk, 2007, Wu and Wang, 2005, Yang, 2007, Legris et al., 2003).

5. The main factors that influence individual behavioural intentions and encourage positive sustainability behaviour in particular. Also the concepts pertaining to the design of specific sustainability intervention techniques affecting an individual sustainable lifestyle (Midden et al., 2007, Froehlich, 2009, Björkskog et al., 2010, Holmes, 2007, Davis, 2008a, Davis, 2009, Wattson, 2013, Martinez and Geltz, 2005, Midden et al., 2008, Pousman and Stasko, 2006, He et al., 2010, DiSalvo et al., 2010, Froehlich et al., 2010, Chisik, 2011, Yao and Zheng, 2010, Doukas et al., 2007, Benders et al., 2006, Abrahamse, 2007b).

One of the main outcomes of the literature review stage of the research design methodology is the provision of guidance for the process of conducting a literature review that contributes during the conceptual model development process. In these terms, the research conceptual model will be primarily developed based on the broad literature review of related aspects in relation to the research questions. Furthermore, both effective research questions and the formulation of hypotheses are based on an appropriate methodological framework that is designed to enable a valid and reliable literature review in relation to the research problem.

4.9.2. Stage two: Survey user evaluation of the research model innovation characteristics, TTF and net-benefits

The second stage of the research design methodology intends to provide a deeper understanding of the context of the research situation by investigating the user perceptions, attitudes, beliefs and opinions about technology innovation characteristics, task-technology fit and electronic services adoption in a utility management context.

One of the main objectives of the research design in this stage is to empirically assess the existing situation and obtain important factors that have an impact on influencing the user evaluation of task-technology fit and behavioural intentions towards the adoption of new technology innovations for managing utilities services online. With this understanding, parties responsible for utility provision and the technology innovation development associated with it can have an effective means to embrace the major influencing factors that can support their decision making process that aims to positively influence the users' perceptions and consequently increase their intention to adopt this service (Jackson et al., 1997). As discussed in the conceptual framework development section presented in Chapter

3, to achieve its initial purpose, this research aims to employ an appropriate methodology for the investigation of the user evaluation of technology innovation from the task technology-fit perspective. According to Vijayan et al. (2005), the "task-technology fit" adoption approach outlined by the TTF Theory appears to be the most comprehensive in explaining user perceptions of technology fit with their task requirements. Thus, it was chosen to provide the basis of investigating the user perceptions in this respect, since the main purpose of this research is to initiate an appropriate model of technology innovation that matches utility user task needs and open to adoption from the user intentional perspectives.

According to Stroh (2000), a questionnaire is a survey method strategy that is used to explore a broad section of different individual views from the sample population. It is also used to provide a more comprehensive view of factors that may have an impact on users' decisions regards the adoption of internet technology innovation services. However, this study's nature is attitudinal as it aims to measure users' perceptions, attitudes and intentions to use the technology innovation and electronic device for managing their utilities services online. Thus, a large-scale questionnaire method has been chosen to be employed at this stage of the research to provide a broad understanding of the users' perspectives with regards their evaluation of the technology innovation services appropriateness for achieving their objectives of managing their utility service related tasks online. In addition, this type of research survey strategy (questionnaire) will be used as a means to gathering the necessary data for a statistical data analysis providing generalisations of the results. The decision to adopt this type of research tool is based on the statistical belief, that designing a large questionnaire will result in the collation of unbiased findings that can be generalised over the sample population (Miller and Acton, 2009).

A questionnaire will also be used in this stage of research design as a data collection method providing an increased understanding of the current state of user perception regards desirable technology innovation and in order to obtain a profile of utility user personal characteristics (including gender, age, income etc.), Internet experience and behavioural characteristics, as well as to provide insight into the contributing variables of users perceptual evaluations with regards to their opinions on the most preferred technology innovation characteristics and technology-fit with task requirements that will influence their innovation technology adoption. The questionnaire will in addition provide detailed information about national culture and attitudes toward aspects in relation to user technology innovation adoption in the context of using technology in managing utility services online.

The following sub-sections will provide a detailed description of the survey design methodology (questionnaire) deemed as an appropriate method for conducting one of the main empirical parts of this research stage.

4.9.2.1 Questionnaire design and development process

The questionnaire is developed to achieve the purpose of this stage of research objectives. The detail of the information that will be collected at this stage depends mainly on the conceptual framework and the underlying constructs that will be researched. In this study, three main areas of literature were surveyed in order to develop the conceptual and theoretical framework that includes several measurement constructs in technology adoption, user evaluation of TTF and technology's role in promoting an individual's sustainable behaviours, which, in turn, establish the basis for the process of developing and operationalising the constructs in the questionnaire. Thus, developing the questionnaire instrument in this stage of the research process will precisely follow phase I of the theoretical framework developed in Chapter 3, collecting responses from the sample population on two main user perspectives: The user evaluation of the research model TTF and their perception of the 'net-benefit' outcomes as well as general information about user demographic characteristics, previous Internet experience and usage behaviour. Specifically, the questionnaire operationalisation constructs cover information on: general user socio-demographic and Internet usage characteristics (namely, demographics, prior-experience, use purposes, access location, adoption behaviour) and other specific information regards the investigation of user perspectives on factors affecting eService adoption, the research model's TTF and net-benefit in relation to user tasks of managing their utilities services online.

Given that the target population of this research is all utility services users in Riyadh with an Internet connection, the questionnaire was designed to investigate the main variables that form the user intention to use the technology innovation when conducting transactions of utility management online. In this regards, previous research in the literature review chapter was the main source for selecting the variables that will be used in the theoretical framework and then in creating the relevant questions that will be included in the final questionnaire instrument. The measurements of innovation technological characteristics, task characteristics, and user evaluation of information system net-benefit outcomes were used following the success of several related studies and theories in the field of information systems (specifically, a modified model of Delone's work (Delone, 2003)), TTF, TAM, DOI, perceived characteristics of innovation and TPB (Taylor and Todd, 1995a).

The questionnaire item uses a unidimensional 5-point Likert scale to collect the responses for the constructs of the research model from the participants. Questionnaire constructs will be measured using multiple items that were obtained from similar item measurements in previous studies when feasible and similar scales will be adopted as required. Items from previous research undertaken in the field were adopted with some modification to allow them to suit the research context. Furthermore, new items were introduced as required because technology adoption of an integrated virtual enterprise environment in utility management is an emerging field. However, the majority of questionnaire items were adopted from related studies in information technology adoption and the research field of user eService's adoption in e-government, e-commerce, e-banking and e-shopping literature were particular contributors. Table 4-2 presents the main measurement constructs and item scales used in the questionnaire instrument in this research stage of the study

Table 4-2: Operationalisation measurement constructs and item scales used in the research questionnaire instrument (Stage II)

Measure of technological innovation characteristics of the proposed platform				
DeLone and McLean (1992) IS success Dimension		Decomposition of technological characteristics	Items	Item description
Innovation-Technological-Characteristics	Technological-information Characteristics	- Integrated/shared information environment - Sustainable information medium - User-centric information technology -	TINF1	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utility services, would you prefer the inclusion of real-time integrated feedback on resource usage?
			TINF2	Are you interested in having detailed information about all your utilities resource usage? (i.e. a bill with detailed information about resource usage)
			TINF3	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utility services, would you prefer to include user-centric real-time promotion, recommendation and advice?
	System-technological Characteristics	- Single window administration - User profiling - Stakeholder integration and service exchange operability - Collaborative virtual enterprise (VE) infrastructure	TSYS1	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utility services, would you prefer to include single point management to the existing utilities subscription?
			TSYS2	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utility services, would you prefer to include user profile information?
			TSYS3	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utilities services, would you prefer to include customized e-participation services with sustainable communities?
			TSYS4	If integrated utilities services management is made available to you, would you prefer the new innovation system to be adaptive to your profile information?
			TSYS5	If integrated utilities services management is made available to you, how likely would you be to be willing to accept the mediation of a third party to provide an interface between you and other service providers?
			TSYS6	Do you think that there is a need for more investment into the dynamic integration of all utility services to promote online benefits of use and to encourage utility customers to use them?

Table 4-2: Operationalisation measurement constructs and item scales used in the research questionnaire instrument (Stage II)

Measure of technological innovation characteristics of the proposed platform				
DeLone and McLean (1992) IS success Dimension		Decomposition of technological characteristics	Items	Item description
Innovation-Technological-Characteristics			TSYS7	Do you feel there is a lack of integration with your utility services providers?
			TSYS8	In the case of the availability of an integrated utilities services management resource to use as a single point of access for all your utility services, would you prefer to include online interaction with service providers?
			TSYS9	If integrated utilities services management is made available to you, how likely would you be to be willing to participate online with other utilities stakeholders with a view to better natural resource saving?
	E-service's delivery dimension	- 'One-stop' service delivery approach - User-centric services - Integrated online services portfolio - Personalisation and customisation - Sustainability-centric services design - Access channel medium	TSDY1	Are you interested in using an integrated utilities service management innovation for one-click admin to all utility accounts?
			TSDY2	Would you value a personalised (user-centric) interface of online utilities services?
			TSDY3	In the case of the availability of an integrated utilities services management resource to use as a single point of access to all your utility services, would you prefer to include integrated e-services provision?
			TSDY4	Are you interested in having a personalised service provided within an integrated utilities service management innovation?
			TSDY5	In the case of grouping (real-time) online utilities services in one place, does that make you inclined to increase use and adopt these services?
			TSDY6	In the case of the availability of an integrated utilities services management resource to use as a single point of access to all your utility services, would you prefer to include visual monitoring of consumption?
			TSDY7	What channels did you prefer, that you find convenient?

Table 4-2: Operationalisation measurement constructs and item scales used in the research questionnaire instrument (Stage II)

Measure of technological innovation characteristics of the proposed platform				
DeLone and McLean (1992) IS success Dimension		Decomposition of technological characteristics	Items	Item description
User-Tasks-need-Characteristics	Informational-tasks	- General utility service information - Utility services news and status alerts - Subscription status information - Service regulations updates Information - Consumption status information - Avatar informational advice	TSNF1	From my point view, adding a tasks that provide a general information about utility services within the technology platform will positively effects my perception of technology fit?
			TSNF2	From my point view, adding a tasks that provide a news and service status alert about utility services within the technology platform will positively effects my perception of technology fit?
			TSNF3	From my point view, adding a tasks that provide subscription status information about utility services within the technology platform will positively effects my perception of technology fit?
			TSNF4	From my point view, adding a tasks that provide information about services regulation updates within the technology platform will positively effects my perception of technology fit?
			TSNF5	I am interested to have a tool providing consumption status information, and, the availability of such services will increase my perception of technology fit with my needs?
			TSNF6	If integrated utilities services management is made available to you, adding recommendation and advice services will make the technology better match with my tasks needs?
	Administrative-tasks	- Account information access - Utility subscription/account management - Consumption Real-time monitoring, control and analysis - Financial and cost management services	Adding a tool for Administrative tasks within the integrated utilities services management platform will positively affect my technology match perspective? That services includes:	
			TADM1	Accessing utility accounts information?
			TADM2	Utility subscription and account management?
			TADM3	Real-time consumption monitoring, control and analysis?
			TADM4	Financial and cost management services

Table 4-2: Operationalisation measurement constructs and item scales used in the research questionnaire instrument (Stage II)

Measure of technological innovation characteristics of the proposed platform				
DeLone and McLean (1992) IS success Dimension		Decomposition of technological characteristics	Items	Item description
User-Tasks-need-Characteristics	Transactional tasks	- Set-up account - Transfer account capabilities - Change tariff scheme of the services - Bill-payment services - Status management of utility service	Adding a tool for transactional tasks within the integrated utilities services management platform will positively affect my technology match perspective? That tasks includes:	
			TRNS1	Ability to set-up new account
			TRNS2	Transfer account capability
			TRNS3	Change tariff scheme of the services
			TRNS4	Online bill-payment services
			TRNS5	Status management of utility services
	Sustainability related functionality	- Sustainability knowledge and awareness functions - Setup resource usage goal setting - Consumption feedback and usage demonstration - Control and monitoring function - Consumption efficiency analytical functions - Regional/neighbour comparative feedback - Pro-environmental user-specific recommendation function - Engagement in sustainability campaigns - Link with sustainable parties (sustainable communities, policy makers, sustainable solution industries etc(. Sustainable lifestyle performance labelling and rewards functions	Adding a functions within the integrated utilities services management platform that provide a services for help in saving resources, consumption feedback and promote sustainability will positively affect my perception of technology match perspective? That functionality includes:	
			SUST1	Information about the sustainable use of resources
			SUST2	Consumption usage feedback
			SUST3	Function of setting of resource usage limit
			SUST4	Consumption monitoring and control
			SUST5	Consumption analytical functions
			SUST6	Usage comparative feedback (regional /neighbour)
			SUST7	Active advices and recommendations about sustainable choices
			SUST8	Involvement and participation with Sustainability stakeholders
			SUST9	Function of linking me with sustainability parties
			SUST10	Information about my sustainability performance

Table 4-2: Operationalisation measurement constructs and item scales used in the research questionnaire instrument (Stage II)

Measure of technological innovation characteristics of the proposed platform			
DeLone and McLean (1992) IS success Dimension	Decomposition of technological characteristics	Items	Item description
User perceptions (value/net-benefit)	- Convenience - Cost saving, time and effort - Avoidance of personal interaction - Communication - Control - Personalisation - Ease of information retrieval - Well-informedness - Trust - Participation in decision making	NBNF1	If integrated utilities services management is made available to you, how likely would you be convenience and willing to try using it?
		NBNF2	For me, using the innovation of integrated utilities service management for one-stop service and resource management of my utilities portfolio will help me in saving my time, cost and effort
		NBNF2	For me, using the innovation of integrated utilities service management for one-stop service and resource management will ease my interaction by avoid branch visit to have a services in person.
		NBNF4	The innovation of integrating all utilities services in a one-stop service management platform will benefit me as regards to the facilitation of ease of interaction with all service providers
		NBNF5	The innovation of integrating all utilities services in a one-stop service management platform will give me control to meet targets that address resource usage depletion
		NBNF6	The innovation of integrating all utilities services in a one-stop service management platform will benefit me to have a customized and personalised services
		NBNF7	The innovation of integrating all utilities services in a one-stop service management platform will benefit me by making my task of retrieving a utility related information an easy tasks
		NBNF8	The innovation of integrating all utilities services in a one-stop service management platform will benefit me by increasing my awareness of resource and energy use
		NBNF9	For me, using the innovation of integrated utilities service management for one-stop service and resource management of my utilities portfolio will present a significant risk
		NBNF10	For me, using the innovation of integrated utilities service management for one-stop service and resource management of my utilities portfolio will present a new benefit participation channel to interact with decision maker in related to utility services

4.9.2.2 Pre-test and pilot test

As a part of effective questionnaire design it is necessary to conduct a pre-test and pilot test of the questionnaire instrument before data collection takes place in order to ensure the instrument's validity and that it is error free (Compeau, 1995, Crouch, 2003, Blair, 2014). According to Baines and Chansarkar (2002), the pre-test is essential for completion prior to data collection because the pre-test can have an impact on different elements of the questionnaire design process.

In this research two essential tests were employed to improve the content validity of the questionnaire. Firstly, a pre-test was held by collecting data obtained from the feedback of a random selection of current utilities customers. Respondents were requested to provide a review in terms of the completeness of the questionnaire items in investigating their perspectives with relation to the model's technology-fit and to the adoption of electronic services in a utility management context. Any other factors not in the original questionnaire and considered important from the user point view will be specified and evaluated before including them in the instrument. In this test, the respondents were requested to complete their answers to the items as a means to examining the content validity and clarity of the questionnaire. As a result, the questionnaire's wording was adjusted as required and unclear questions were rephrased accordingly. The length of time to complete the answers of the questionnaire items was calculated during the pre-test, and an average of 7 minutes for the respondent to answer all questionnaire items was estimated.

Secondly, a pilot-test of the questionnaire was conducted by collecting data from 23 random respondents from the target sample population of this research. The statistical analysis package software SPSS ver. 20 was used to analyse the data and perform the pilot-test of the questionnaire. Different issues were inspected for example: response completeness, scale reliability and measurement construct validity. As a result, relevant modifications were made to the final instrument as required.

4.9.2.3 Survey target population

As the main objective of this research is to investigate the appropriateness of the research model in contributing to user technology adoption and the promotion of individual sustainable behaviour, this research tries to understand certain user requirements in order to improve user technology adoption and e-utility services and to provide a framework for technology innovation that can enable users to achieve their task requirements of managing their utilities services online. In this regards, since there were different technological aspects involved in this context, it is expected that both existing and potential technology users are already familiar with the Internet before they become involved in the research of investigating users' intentions towards using technology services for the purpose of online utility services management. Therefore, the best target sample population for this research is Internet-users. According to Andersson and Gronlund (2003), Internet users are ordinary users who use the Internet for different purposes such as informational, business, social or other services.

The significant underlying reason for selecting Internet-users as a target sample population of this research is that a user who is not familiar with internet services will not be able to evaluate the internet e-technology services (Welch et al., 2005). Also, when the aim is to motivate new users to use the internet technology services, the most effective means of enhancing adoption will be achieved when the focus is directed towards understanding the Internet-users' requirements (Reddick, 2005). Based on the nature of the technology framework of an integrated virtual enterprise environment of utilities management, which is considered a new emerging technology innovation to be developed, the most suitable target sample population to be investigated is the potential user (and not the users) of the research model by means of surveying their perception of the framework TTF and their expectation of the net-benefit outcomes. The emphasis is on examining the user's future intentions to use the technology framework, rather than measuring their actual use of such technology services. This approach has been endorsed by different related research studies conducted by Carter, Belanger and Schaupp (Carter and Belanger, 2004b, Carter and Bélanger, 2005, Schaupp and Carter, 2005) in which they measure user intentions to use e-technology services by examining the future intentions of internet-users exclusively (to the exclusion of non-Internet users) in their research sample populations. It was rationally observed that internet and technology familiar users will be more able and skilled to judge the users acceptance of new emerging technologies and to predict their future behaviour regards technology adoption. Furthermore, it was widely recognised that there is a greater diffusion of technology innovation achieved among users that are familiar with the Internet and those open to new technologies (Quirchmayr and Slay, 2001).

The sample population in this research are Internet familiar users, regardless of whether they are a user's or non-users of electronic services. Furthermore, it is not required that sample candidates are already a user of any specific service over the Internet. The sample will include users who have the ability to use the new technology innovation by themselves. Users without Internet access and not familiar with using Internet services in most situations will have a lack of the necessary skills and information to access the Internet and a disadvantage in using the electronic services provided by organisations. Therefore, Internet users will be considered the most representative sample population of this research. The rational choice of selecting this sample type of users in the context of this research relies on the underlying facts that: i) Saudi users are able to have easy access to Internet services using a fast and more reliable connection than before, which makes them an appropriate target sample of potential users, that are most likely to use the technology innovation model; and, ii) the high Internet penetration rate among Riyadh's population which is 137%, where internet users represent 48% of the Riyadh census. This implies that by approaching internet users in Riyadh city, this research will be addressing at least 48% of the Riyadh population capable of being potential users of the research technology innovation framework (or the one-stop' model) in the future.

In summary, by considering these reasons, the chosen target sample population of this research is identified as the ordinary adult with prior experience of using Internet services who lives in the city of Riyadh. The selection of Riyadh city from which to draw a sample population for this research is due to the fact that it is the capital city of Saudi Arabia with a large population compared to other Saudi cities and it can represent Internet users from all over Saudi Arabia. A higher percentage of Internet users is found in Riyadh city than any other city in the country. It was also found that it is more attainable to target a population where the researcher has the best means of organisational and social connections to support access to the sample population.

4.9.2.4 The research sample design and data collection method

Since it was decided that the research target population and the questionnaire survey strategy were the most appropriate to be employed in this study, the following step is to design the sampling approach that will be used as a framework for collecting required research data from the target population. According to Churchill and Iacobucci (2009), the sample design includes specifying the sampling frame, sampling method and sample size. All of these sampling design elements will be identified in accordance with the current research stage and nature of the research problem. This will be followed by an identification of the data collection approach that will enable the assembly of research data in order to achieve the study's objectives. The following sub-sections will present a description of these two aspects in detail.

4.9.2.5 Sampling frame and sample size

After identifying the target sample population of this research, the next step is to define the sample frame and size, according to which a random sampling will be conducted. According to Saunders et al. (2008), the sample frame is a list of all items in the research target population that a researcher will use to define their sample (Saunders et al., 2008). Finding a sample frame that represents the target population is considered a basic and essential step in establishing any type of research. Defining an effective sample frame to be applied to the research study is the primary indicator of the reliability of the findings to be obtained from examining the research hypotheses as well as the subsequent results of the statistical analysis. Thus, it was advised that particular consideration be given to the step of determining the sample frame and size, which mainly depends on the nature of the research problem under study.

Sample size is another important element in the consideration of effective research design. According to Tuckman and Harper (2012), the sample size has to be sufficient and large enough to be certain that it is a representative sample population and to avoid the effects of sampling errors. It is also necessary to define the proper sample size in order to fulfil requirements of the statistical method that will be used in the data analysis phase of the research.

To achieve the objectives of the research, sample frame was identified using the Riyadh national utility database that contains utility customers' records. A sample frame of 331,012 customer's information was chosen in an attempt to achieve a target sample size of 1,500 respondents. The availability of such a frame for this sample population confirmed the applicability of applying random sampling in this research. In order to examine the new technology innovation model, the sample of candidates chosen to respond to the questionnaire was selected randomly from ordinary adult people who are living in Riyadh city and who are familiar with Internet services. The sample frame was identified containing a detailed record of utility customer information, such as, customer contact numbers, location and other information that was partially available, such as their mail and email addresses. It is expected that the target sample population have prior general experience in using the Internet and that it includes both users and non-users of online technology services provided by any organisations.

4.9.2.6 Questionnaire administration and distribution technique

In this study, the self-administered web questionnaire was used (see Appendix C), based on the underlying features of such a technique compared to other survey methods. These include: i) its ability to obtain a greater number of respondents from a large sample population, ii) ease of implementation, iii) lower interview bias, iv) a real-time input data validation, and vi) a lower cost compared to other methods. The questionnaire website was typically developed to provide a survey instrument that is easy to access and which was equipped with the ability to provide complete responses, real-time data validation, and a fast response rate. The data collection in this type of questionnaire is system administered, where the web questionnaire remains unsupervised during the survey data collection process (Fink et al., 2003). To achieve a higher response rate from the respondents, Kaplowitz et al. (2004) suggest that a web questionnaire is the most appropriate survey method as long as the respondents are familiar and feel comfort with using the Internet. In line with this stipulation, it is apparent from a previous national survey conducted by the Saudi National Statistical Office in 2006, that Internet penetration rates in Saudi Arabia (In particular, in Riyadh city), which is estimated to be 26.2 percent of the Saudi Arabia census (The National Statistical Office, 2007), are high, makes the feasibility selecting the web questionnaire more apparent for use in this study.

Having described the survey type and administrative approach, questionnaire distribution technique is another essential element of survey strategy that requires an effective decision in terms of selecting the most appropriate distribution method. According to Pavlou (2003), the distribution technique is a method of contacting a sample population to request the participants response to the survey when the web questionnaire is the only a method for data collection.

Using this approach, there are many distribution techniques that can be applied to promote completion of the survey questionnaire. These include contacting the participants by mail, drop-off pick-up, drop-off mail-back, telephone calls, e-mail or other internet communication means.

Using mail as a distribution method was not feasible for application in this research based on national statistics on mail services. The existence of a limited number of active mail-boxes, estimated at 61,000 in Riyadh city, shows that only 15% of households have a valid mail address. Thus, it is observable that most people in Riyadh do not have personal mail boxes and the services are not used widely as means of communication as is the case in developed countries. In this study, mail questionnaires would be time/resource consuming distribution techniques and most likely would result in a long turnaround time with a low response rate. Furthermore, it would be more effort consuming than e-mail, telephone calls and online distribution methods; therefore, it was decided that a postal questionnaire was not feasible to be employed in this study as a distribution method.

Drop-off mail-back or drop-off pick-up distribution methods have been used as an alternative to distributing self-administered questionnaires by mail. In this distribution method, a researcher visits the household at home to deliver the questionnaire to the respondent and collect if after completion personally. Drop-off mail-back or drop-off pick-up questionnaires are difficult for deployment in this study because it is considered more time-consuming, costly in terms of administration (Hair et al., 2003), expensive and requires human resources. Furthermore, visits to respondent's residential premises to deliver the questionnaire or to meet them face-to-face to gather information are not welcomed in the context of the Riyadh population for reasons of privacy, norms of cultural practice and social considerations.

Telephone contact with participants requesting that they answer the web questionnaire could be considered the typical distribution technique used in this study as the target sample population was selected to be familiar with the web and Internet services. The customer data that includes their contact information will be used to contact random participants to request completion of the web questionnaire (using telephone calls and shot-messaging systems (SMS)). This method was assumed to be the most appropriate, economic and less resource and time consuming. E-mail will be used as an additional distribution method (as long as the addresses are available in the customer records) to invite the participants to complete the web questionnaire by sending the web-link to their registered e-mail address.

In fact, using this approach would provide better results in terms of a response rate, as it is easier for respondents to complete a questionnaire over the web. It also harbours several advantages for both researcher and respondents because completing the questionnaire online saves both resources and time. Moreover, it is most economical and applicable method to be applied in this study compared to other distribution techniques (Bourque, 2003, Baines and Chansarkar, 2002).

In summary, considering the situation of this study, it was specified that the most appropriate survey instrument is the web self-administered questionnaire that will be distributed to the respondents using available contact information by telephone and SMS messages. The e-mail address was used as an additional distribution method when applicable. As a result, 1193 returned completed questionnaires online submitting them to the website database. The response rate was 81%.

4.9.3. Stage three: The prototype development methodology

The third design stage of the research methodology is concerned with the development of the methodological approach that will be used to develop the prototype mock-up system that will demonstrate the dimensions of the research model components (see Appendix B). It is considered as a step further in the process of validating the research model and investigating the user perspectives towards the validity of the new technology innovation model as an emerging technological framework that enables better user technology acceptance and promotes individual sustainable behaviour.

A system development methodology is a formalised approach that includes a sequence of tasks and activities used as a framework to implement information systems. According to Satzinger et al. (2008, p.49), a system development methodology is defined as "guidelines to follow for completing every activity in the systems development lifecycle, including specific models, tools, and techniques". An effective information system development methodology relies upon having a well-defined plan that contains a description of organised tasks and activities that will be followed to achieve successful system development (Satzinger et al., 2008). In the following section, I will present the detailed alternatives of available system development methodologies, approaches and life cycle models with a critical evaluation of the most appropriate development methodology approach that will be employed in this research to be followed for the development of the prototype mock-up system to validate the research model.

4.9.3.1 Prototype system development methodology alternatives

The success of developing the mock-up prototype system of this research is dependent on the selection of an appropriate system development methodology approach and life cycle model that will be used, the identification of which requires consideration of different aspects including the nature of the research, available resources and targeted objectives that will be achieved. Different system development methodologies have their different approaches, characteristics, applications as well as specific system development life cycle model (SDLC). A SDLC is the framework that specifies the way that the information system development process will be followed in order to develop a specific information system, which includes a sequence of tasks and activities that are organised in such a manner so as to complete the development process and attain successful system implementation (Pfleeger, 2001). SDLC models can be explained as guidelines that form the system development process, phase sequence and the criteria to proceed from one phase to another throughout the system life-time development. However, It is widely recognised that no common system development life cycle approach is considered valid and appropriate for all information system development and implementation (Pfleeger, 2001). Thus, each system development life cycle approach is appropriate for specific implementation based on the development context. Several information system development approaches have evolved to deal with new requirements of application development and life cycle approaches. According to Tegarden (2013), there are three different categories of system development life cycle approaches, which are: i) structured design, ii) rapid application development (RAD), and iii) agile development approaches. The detailed description of these categories is summarised as follows.

- *Structured Design Systems Development Methodologies*

The first systems development methodologies emerged to overcome the disadvantages of the previous system development practices, which were usually informal, unplanned and unmanageable approaches. Structured design methodologies define an organised formal sequence of stages that are defined in the system development life cycle model and transfer logically from one step to another in linear fashion. Different linear sequences of steps were used, starting from an initial stage of defining the requirements followed by system development, implementation, operationalisation and concluding with system evaluation. Two methodological categories follow this type of structured design approach including, waterfall development and the parallel development model that uses linear development.

- *Rapid Application Development (RAD)*

The new approaches of system development were categorised as Rapid Application Development (RAD) methodologies. They were new methodologies that tried to overcome the deficiencies of previous structured designs of systems development methodologies. In these approaches, attempts concentrate on providing a system development process that enables quick and gradual delivery of system components to the user. In RAD, the system development life cycle SDLC is modified accordingly to enable fast system development with more emphasis on issues related to system life cycle phases in order to deliver quick system development and, additionally, to deal with the needs of ongoing inclusion of user requirements and user involvement during development process. The rapid application development methodologies are more focused on understating user requirements alongside the system development life cycle phases and the final system components are expected to be more in harmony with user expectations and needs. Throughout the analysis phase of RAD methodologies, specific software tools are used to gain better understanding of user needs and to help shorten the time needed for system analysis, design and implementation. Using such techniques makes the RAD-based methodologies able to deliver quicker system development with better quality.

According to Tegarden (2013), there are three methodologies that follow the basic structure of the RAD approach. These include phased-based, prototyping-based and the throwaway-prototyping system development methodology. These models can be described as follows:

1- *A phase-based development*: In this type of methodological approach, the system development process is carried out throughout by dividing the whole software system into different system components, which will be developed sequentially into different system development phases. System requirements and development phases are classified and prioritised according to their level of importance. Afterwards, the development will be conducted integrating the most fundamental of the system components delivering the first version of the system development. This is followed by the development of the next system components sequentially to gradually deliver a sequence of system versions and then the overall system development.

2- *Prototype-based system development methodologies* are generally used after an initial identification of fundamental system requirements. In this stage of the methodology, the team has a preliminary understanding of the system and user requirements with a need for additional clarification or modification of those requirements that is typically obtained from the users. Subsequently, the prototype system is developed and the end-users are given a chance to explore, use and evaluate the prototype system. The system development team use user feedback to then modify the prototype system. Afterwards, the next created version of the prototype system, which includes new requirements are available to the end-user to provide their further requirements, expectations and feedback once again. These steps of prototype system development are a continuous process that occurs repeatedly until the feasibility of obtaining new requirement feedback and modifying the system is rationally worthless with regards to an evaluation of cost and time needed. Eventually, the final requirements are attained and the overall system development is achieved with better quality and understanding of user needs.

3- *Throw-away Prototyping, (or mock-up) development methodology* is a similar approach of prototype system development as that described earlier, except that the development of the prototypes is a dummy and tools are non-functional, in such a way that it is used for presentational purposes only. It serves the goal of demonstrating the system development and enables the user to visualise its functionality. The next step is to create another prototype that will include the new system requirements and user feedback. These iterative cycles are carried out repeatedly until the development team presents a comprehensive visualisation of a prototyped working system. In this approach, it is advisable that the development team conducts initial system analysis to gather the fundamental system requirements before the team develop the first mock-up prototype in order to enrich the prototype with sufficient information about the requirement of the actual system. The superior feature of this approach compared to other relevant prototype methodologies is its ability to deliver a rapid and complete system rather than a partially developed system as in other prototype approaches. It is recognised as an effective methodology, providing development teams the advantage of less development complexity and quicker system development compared to other methodological approaches.

- *Agile System Development Methodology*

The Agile system development methodology is considered a newly emerging approach that was introduced in 2001. Agile development is a collection of iterative and incremental system development methods in which the system development solution is gradually improved through a series of collaborative teamwork efforts between different project team members. It is more flexible in terms of adaption and implementing changes during the development phases to support the rapid and complete system delivery. Compared to other system development methodologies, agile development is mainly introduced for complex system projects within a group of system development teams working in dynamic and frequently changing environments. One dominant example of agile development methodologies is the extreme programming methodology (XP), which is commonly used alongside an object-oriented software engineering approach.

Table 4-3 presents detailed information about different categories of system development methodologies with description highlighting the system life cycle models and a conclusion of the main advantages and disadvantages as concluded from the literature review.

Table 4-3: Summary of different system development methodologies from the literature (Source: Author)

Development methodology categories (Tegarden, 2013)	Model name/type	Phase of life cycle model	Advantages and disadvantages
Structured Design methodology	Waterfall Model (Linear)	Requirement Definition→Development and implementation → operation	Advantages: - Strictly complete each stage before going to the next stage - System specification is fixed at an early stage - Easy to manage the schedule - High reliability - Suitable for large-scale systems that require high reliability Disadvantages - Difficult to respond to change in user requirement - Users cannot examine the system until the operational test - Long development period
	Parallel development model (Linear)	Parallel Requirement definition→parallel development and implementation → operation	
Rapid Application Development (RAD) methodology	Phased development model (Combination linear and Iterative)	Phase-based Requirement definition→ Incremental development and implementation → operation	Advantages: - Suitable for a small scale system - Rapid development with shorter development time and high quality - Make prototype in early stage - Good communication with users Disadvantages: - Need highly skilled system engineers - Difficult to manage the schedule
	Prototyping (Iterative)	Requirement Definition (Reduced)→Quick development and implementation → operation	
	Throwaway prototyping model (Iterative)		

Development methodology categories (Tegarden, 2013)	Model name/type	Phase of life cycle model	Advantages and disadvantages
Agile Development methodology	Extreme programming (XP) (Iterative and incremental development) Dynamic systems development method (DSDM) Scrum Model	Concept definition →Inception (warm-up) →Construction → transaction→ production→ retirement	Advantages - Adaptive to respond to the changing requirements. - Face to face communication methodology with continuous input from users - The end result is the highest quality in the least possible time with customer satisfaction. Disadvantages - Difficult to assess the efforts required at the beginning of the development life cycle. - Lack of emphasis on the necessary design and documentation. - Agile requires more re-work because of the lack of long-term planning - Lacks attention to outside integration.

4.9.3.2 Selecting the appropriate development methodology of the study

Since there are many system development methodologies in the relevant literature that would be appropriate for different system development situations, the first challenge facing system developers is to decide which methodology will be most appropriate for adoption in their particular development of the system. Selecting a proper methodology for system development is not a straight-forward or simple task given that no common system development methodology is always applicable for all situations. Furthermore, the choice of an appropriate lifecycle paradigm is another important contributing factor to be considered in successful system development. Using a methodology as the foundation for guiding the system development process will lead to better organisation of the actual process of project development that will hopefully lead to optimal system implementation. According to Tegarden (2013), the selection of an appropriate system development methodology is affected by an ambiguity of user requirements, including: level of system complexity, prior-experience with the underlying technology, time frame, criticality of system reliability and a need to see progress alongside system development phases.

This research aims to develop a rapid prototype (mock-up) system that enables users to visualise the real workings of an integrated virtual enterprise utility management system (or ‘one-stop’ system) to obtain more understanding into the user evaluation of the new technology innovation framework and validate the research model. As concluded from the system development methodologies comparison with regards to their advantages and disadvantages shown in Table 5-3, the *rapid-throwaway prototyping system development methodology* was deemed to be the most appropriate approach to be used at this stage in accordance with the scope of the research. This methodology demonstrates various superior design advantages and meets with the requirement of rapid development of the intended prototype mock-up system that will be developed in this study. It was determined that it displays several characteristics that fulfil the requirements of the research system development needs, including: 1) good communication with users enabling a better understanding of system requirements from user perspectives; 2) support of detailed analysis and design as well as suitability for small scale system development; 3) delivery of a prototype (mock-up) system at an early stage; and, 4) rapid development within a shorter time frame and high quality, which can enable the researcher to achieve a prototype mock-up system in a quick period of time in order to validate the research model within the specified time schedule. Furthermore, the selection of this methodology is also supported by previous research, which reported that the development of semantic models and the associated conceptual framework is predominantly accompanied by the adoption of a prototyping system development methodology (Pinto and Martins, 2004). It was acknowledged as being the most flexible approach in terms of its capacity to enable development teams to return to previous stages of system development life cycles, in contrast with structured design system development methodologies (Pinto and Martins, 2004). However, the prototype (mock-up) system development approach and RAD-based methodologies typically involve the employment of new software tools and techniques that require sufficient time for developers to learn and practice, which increase the complexity of the system development tasks and require additional time for learning. Such challenges were overcome during the development of the prototype (mock-up) system of this research, where the researcher has prior experience in the technology development field and enough background in ICT development. This experience had a significant effect on increasing the speed of developing the new prototype (mock-up) tools.

4.9.3.3 Prototype system analysis and design approach

The identification of the prototype system requirements analysis and design approach is critical in mock-up system development. Furthermore, the success of the domain analysis and design of prototype system largely depend on the system modelling approach that is used. According to Satzinger et al. (2008), there are two paradigms for system analysis and design, which are classified as structured and object-oriented approaches. The object-oriented approach views the analysis and design of the information system as a group of objects, relationships, and behaviours that are defined to represent a real world situation. This is in contrast to a structural approach, where analysis and design are dependent on defining both the process and data as separate entities. The object-oriented approach is able to conceptualise the real world problem by incorporating objects, relationships, and behaviours in order to build a comprehensive view of the research problem. In this research, for the analysis and design of the prototype (mock-up) system, a 'use case driven object-oriented' approach was identified as the most appropriate to be employed to conceptualise the real world problem of interest to the context of this research. It was adopted to facilitate the requirement of the engineering process to analyse and design the prototype (mock-up) system. However, in the context of use-case driven and object-oriented design activities, this research analyses and designs the prototype (mock-up) system by using the structural and behavioural views of the Unified Modelling Language (UML). This is a well-recognised modelling approach (Burton-Jones and Meso, 2002), that is widely accepted to be the most important methodology for the analysis and design of systems development (Fowler, 2012). Furthermore, there is considerable interest in using UML modelling for domain conceptual representation (Cranefield and Purvis, 1999, Guizzardi et al., 2004) because UML is considered as a standardised and well-defined methodology (Kogut et al., 2002). In this research, UML diagrams (i.e. use case, class diagram, and package diagram) were employed to improve the understanding of the problem domain and show the relationship between the different concepts. Each diagram's view can demonstrate a different structural and behavioural perspective of the system components. The most powerful feature of UML is its capability to comprehensively present an integrated view of different system functional views (or different types of stakeholders' perspectives). UML modelling, with its unique and comprehensive viewpoint, is essential to research when the focus is on the development of a conceptual framework for understanding the different perspectives of a specific problem domain. A 'use-case driven object-oriented' approach is typically conducted by completing four activities of system analysis, design, and development (Jacobson et al., 1999, Van Lamsweerde, 2001), which include:

Activity one: Object-oriented analysis of the system using a use-case diagram:

This analysis phase is based on use-case scenarios that are typically used to enable the analyst to meet engineering requirements and conceptualise the system. A use case driven object-oriented analysis of the system was identified as the most appropriate approach that provides a high quality system requirement engineering output (Jacobson and Christerson, 1995). The use-case diagram was used to represent various functional scenarios of the prototype system of this research in order to provide increased understanding of the real world situation and to conceptualise the obtained requirements, which are also represented by use-case diagrams. The main prototype (mock-up) system functionality of the integrated virtual enterprise utility management system framework (or one-stop model) was represented by the overall use-case diagram, which is shown in Appendix A.

This demonstrates how the user will view the functionality of the prototype system. This view is created by using a use-case diagram for each of the different concepts related to the problem domain, which can provide a conceptual view of the prototype system demonstrating its overall functionality. Its focus is to represent the functions that would be performed, rather than representing how the system will accomplish these tasks. Similarly, other sub use-case diagrams are represented diagrammatically during analysis. In addition, a detailed conceptualisation of the requirements is presented graphically by object and behaviour type, alongside concepts from the technical perspective for further analysis and design.

Activity two: Object-oriented design of system underpinning concepts using a class diagram:

The second activity in the use-case driven object-oriented approach is to design the structural view of the system using a class diagram that describes the object and information structures. According to Fowler (1997) there are three perspectives on the use of class diagrams in an object-oriented design approach, these are: i) a conceptual perspective, where the class is drawn to represent the domain concepts independent from the technical specification and software development environment; ii) a specificational perspective, where more focus is directed towards the design of the technical interfaces rather than their implementation, in which the obtained design can produce different implementation scenarios; and lastly, iii) the most dominantly used perspective which is termed implementational. From this perspective, the class diagrams used are of technical focus and the resultant class diagrams are directly mapped to a technical specification of system implementation.

The early identification of suitable perspectives on the use of these class diagrams is deemed critical in order to achieve the intended objectives of using such diagrams and accomplishing the desired design goal of the prototype system of the study. The perspective that was used in this research was a conceptual perspective of using class diagrams, which was deemed the most appropriate perspective with regards to the context of the prototype system analysis and design approach in terms of the need for structuring the prototype system domain. With regards building the structural view of the prototype system of an integrated enterprise utility management platform (or 'one-stop' model) using the class diagrams, the overall system structure perspective is represented by classes, objects, and relationships, as shown in Figure 4-4. The class diagrams are used to show the system components and the association between them. This prototype system is described by the overall class diagram, which provides a central structural view detailing more specific components of the system. In contrast, the other UML view (illustrating use-case diagrams), will demonstrate the behavioural part of the system.

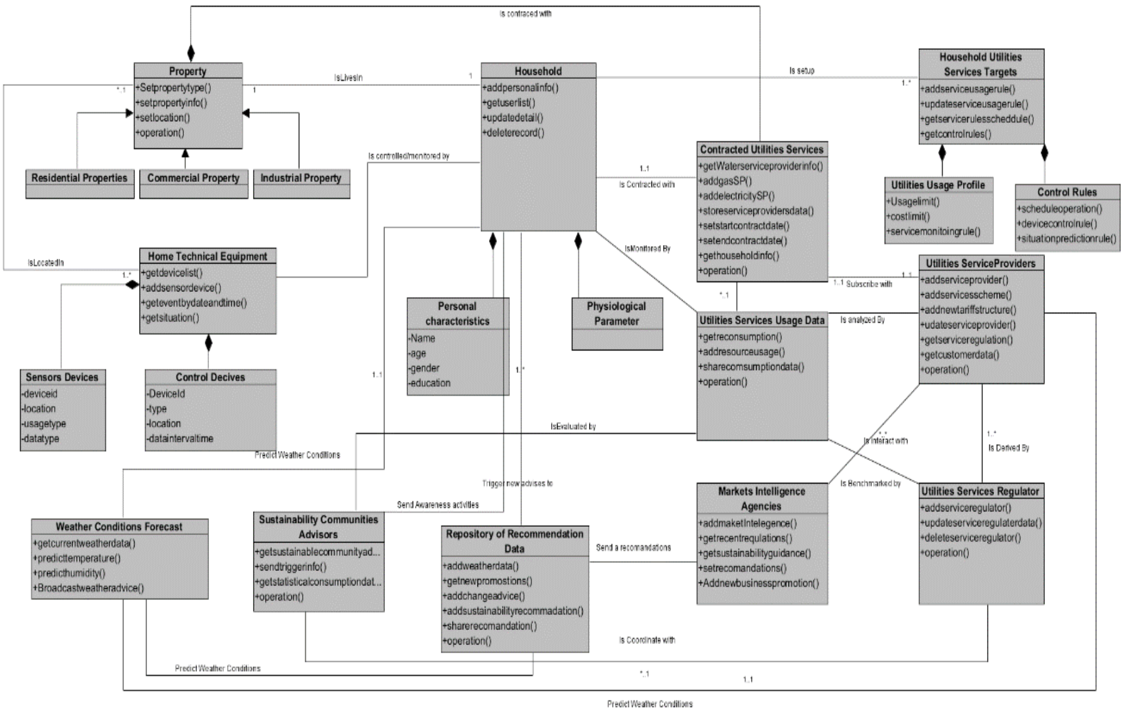

Figure 4-4: Overall structural view of the integrated virtual enterprise utility management prototype system using a UML class diagram

Activity three: Design of prototyping system

The third activity in the use-case driven object-oriented approach is to design the prototype system that satisfies the research objectives of system tools development. According to (Nielsen, 2010) there are three common types of prototyping system design, which are: i) a horizontal prototype, in which the aim is to provide a simulation of the system interface to allow the user to feel all the features of the system with no functions implemented; ii) a vertical prototype, which is used to implement some modules of the system to enable the user to try the functions with more depth, while the remaining features are horizontally prototype to provide the full system of features; and, iii) an analysis prototype, which provides a prototype product that conceptualises the problem domain and demonstrates the concepts to the user as a proof of the concept. This is not used as a basis for the development of actual system. The created prototype will be used to present the concepts to the user rather than coding the system. Finally, a domain prototype is often used to support the incremental development of the actual system by demonstrating the system features during the process of delivering the ultimate system product. In accordance with the different prototype system designing categories, the 'analysis prototype' design is chosen as the most suitable to achieve the aims of this research, namely: conceptualising the problem domain and demonstrating the concept to the user to proof the concepts of integrated virtual enterprise utility management platform (or a 'one-stop' model).

Activity four: Use of component-based development (CBD)

In traditional system development approaches, a basic system engineering process is used during analysis and design phases of the system. The focus is on the iterative development process to acquire the system requirements and build the system, with no consideration given to the employment of the pre-exist system components or re-using such components to build the new system. However, the object oriented design approach provides the framework for the component-based-development model during the system engineering process. The main idea behind this model is to develop the prototype system from the components that already exist by integrating or re-using them to build the component-based system. In the context of this research, a prototype system development strategy rather than traditional non-component based development, which is considered a time and effort consuming approach, is chosen as the most facilitating approach for achieving the ultimate goal of rapid development with less time and effort. The appropriate components are integrated or re-used in the prototype (mock-up) system when it is applicable and seems feasible.

Following this system development strategy, the prototype system development employed in this research is designed based on utilising relevant pre-existing components found in different system applications (when feasible), to facilitate the development of the integrated virtual enterprise utility management prototype system (or 'one-stop' prototype system). The overall logical component-based architecture of the prototype system is shown in Figure 4-5.

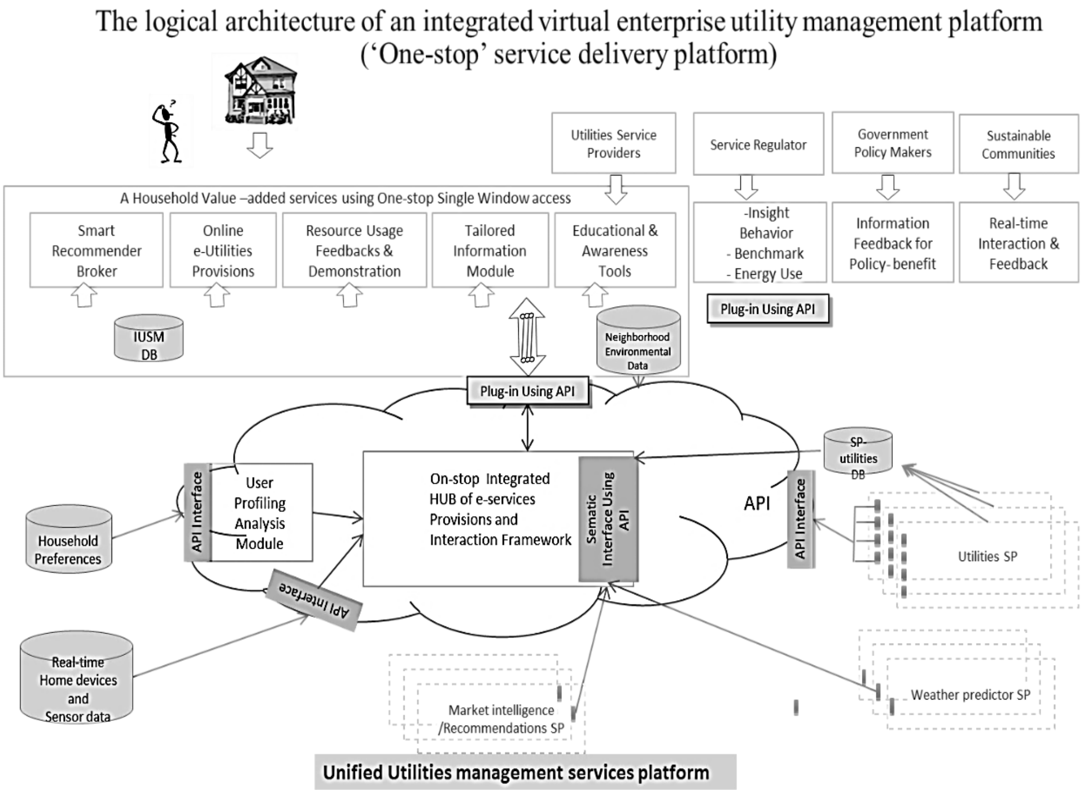

Figure 4-5: Overall logical component-based architecture of the prototype system

The logical system components architecture is based on the proposed research conceptual framework for building the prototype system (mock-up development). The prototype system developed in this stage of research design is used to validate the user acceptance of the technology innovation model presented in this thesis and to evaluate the model's potential influence on their behavioural intentions towards sustainability. The results obtained, validating the model, are presented in Chapter 7.

4.9.4. Stage four: Methodology for validation of the proposed platform

After development of the prototype system to validate user perspectives of new technology innovation characteristics, technology acceptance, the next step is to investigate the potential effects of sustainability related functionality (integrated within the research model) on individual intentions towards sustainable behaviour, as well as to investigate the level of importance of each such sustainability related functionality (i.e. intervention techniques) in relation to its influence on their behavioural intentions. In this research stage, a self-administered questionnaire is used, aiming to answer the research questions and to validate the research conceptual model, which was identified as the main method for collecting data that will be used in the analysis phase of this research to validate different aspects of the research model from the user perspectives. The questionnaire contributes to the research in three ways: i) firstly, by validating the model technology innovation characteristics and predicting the user technology acceptance and adoption of the new technology innovation framework, including adoption of the associated utility electronic services; ii) secondly, by validating the model's potential influence on individual's sustainable behaviour intentions; and, ii) thirdly, by specifically identifying the most critical sustainability related function or intervention techniques that were integrated within the research model to positively influence user behavioural intentions towards sustainability issues.

The questionnaire was put into effect via a self-completion method and it was distributed directly to the participants for them to answer in two parts. This was followed by a session of opinion polls, which made use of a voting system in order to collect data for a third part of the survey, assessing the research model's potential effects on individual sustainable behaviour and to provide increased insight into the most important sustainability related functionalities that will be analysed before being formulated into the final revised model. The detailed development process for each part is as follows:

In the *first and second parts,* the structured and self-administered questionnaires were designed to validate the model technology innovation characteristics, predict the user technology acceptance, and the expected influence on individual intentions towards sustainable behaviour. In order to develop these two parts of the questionnaire, a certain procedure regards questionnaire development was deemed important in terms of considerations related to the nature of this research, namely: a careful review of the research questions to be answered by the participants as a way of understanding the underlying objectives of each part of the questionnaire and to ensure that they were congruous with the ultimate objectives of the research. Then, the theoretical framework used to develop the questionnaire measurement constructs for both technology innovation characteristics, user technology acceptance, and individual sustainable behaviour intentions were verified. This was obtained from the relevant literature review, which was used as theoretical basis for the validation framework that provides several dimensions to the research in terms of investigating the subject matter. This was followed by the development of the questionnaire items with more consideration to the theoretical validation framework, research environment and research objectives.

During the questionnaire development process, some questions were added or modified in accordance with the extensive literature review findings and development of the theoretical conceptual framework. The final modified questionnaire consists of 31 items, which are designed to collect responses using a five-point Likert scale. This aims to gather more comprehensive responses and enable more flexibility during the data analysis phase. Participants are able to express their opinions with regards to the items through a choice of a particular response of, strongly agree, agree, neutral, disagree or strongly disagree.

The third part of the questionnaire that was developed aimed to identify the main sustainability related function that would have a major influence on individual intentions to change behaviour towards pro-environmental sustainability. An opinion-poll questionnaire, using a voting system, was employed in this research to provide more insight into the most influential sustainability-related function affecting individual behavioural intentions. This type of questionnaire allows the researcher to gather further details concerning the level of importance for the various sustainability related functions that were integrated in the research model under study. It is preferable when conducting opinion-poll questionnaires to give the respondents increased freedom in terms of space to express their opinion. In this case, to provide an estimation of the importance of each sustainability-related function and their potential to influence their future behaviour regards sustainability.

Key sustainability related functionalities that would have an influence on individual behaviour were identified and formulated in a list of questions that will be used in an opinion-poll questionnaire to gain more knowledge about individual evaluations of the level of their potential influence on behavioural intentions and to validate each sustainability function. The opinion-poll session was conducted by using a specialised voting system software, namely: the Powercom electronic voting system. The session started by presenting a live and functional mocked-up prototype system and the participants had the opportunity to try sustainability related services in order to gain a greater understanding of the situation at hand. Then, an opinion-poll session was conducted and the data was collected from participants for various items of the questionnaire automatically, using the voting system software, which included 20 questionnaire items.

The survey sampling method employed in this stage of the research is a random selection of participants. They are selected from the list of participants who mentioned in the first survey that they were prepared to be involved in the second part of this research survey. At this stage, a simple random selection technique was used and data was collected from respondents. A total number of 105 respondents provided data using a validation questionnaire that was developed in accordance with the theoretical validation framework presented in Chapter 3. The questionnaire was originally developed in English. It was then translated into Arabic, which is deemed the native language of the participants.

4.10. Data analysis methodology

To provide precise answers to the research questions of this study, the data analysis methodology was identified based on the theoretical framework and research design methodology, as described in this chapter (section 4.9) and 2 and chapter 3, respectively. Accordingly, there are two different phases of data analysis to be carried out in order to achieve the overall objectives of this research.

The data analysis of phase I investigates the user perceptions towards the initiation of an integrated virtual enterprise utility management platform (including perceived TTF and expectations of its net-benefit outcomes). Then, the data analysis of phase IV of validating the research model examines the potential effects on user technology acceptance and promoting user behavioural intentions towards sustainability. The data analysis was facilitated by SPSS software, which is the most powerful statistical software recommended for data analysis (Field, 2010). The software was subsequently identified to be a useful tool to be employed in all further phases of data analysis within the scope of this research.

Different data analysis processes were carried out during the research phases, and the data collection method was in line with the quantitative approach making use of information obtained via survey questionnaires (section 4.6 and 4.8). Typically, in quantitative data analysis, there are several pre-analysis steps that require fulfilment before analysing the data in order to obtain findings in relation to the research questions, these include: data preparation, coding, cleaning and error checking, as well as data transfer to an analytical tool. This research follows a similar sequence of pre-analysis steps towards preparing the collected data for the needs of the data analysis phase. Afterwards, the data obtained by all the research survey questionnaires was tested for their reliability and validity using appropriate statistical methods. Thereafter, a complete data analysis process was conducted underpinned by the initial data analysis results and the data was believed to be ready for further data analysis. It was thus, prepared, screened, corrected, and both the reliability and validity of the questionnaire measurements were tested in their entirety. The results for each phase of the data analysis of this research will be presented in detail in chapters 6 and 7. In the following sub-sections, a description of the data analysis methodology employed is presented in detail. In section 4.10.1 and 4.10.2, present detailed information that will describe the pre-data analysis methods for testing the reliability and validity of the research survey questionnaires and test of multicollinearity of measurement constructs. This is followed by section 4.10.3, which provides information about the statistical methods that had been identified as the most appropriate techniques for analysing the data during the different stages of data analysis in this research to validate the users' technology acceptance of the integrated virtual enterprise utility management model and to examine its potential effects on sustainable behaviour intentions. This section also provides an explanation in terms of the reasons justifying the selection of the specific analytical methods adopted in each of the data analysis phases.

4.10.1 Pre-data analysis: Testing reliability and validity

The pre-data analysis phase is a preliminary data analysis process that tests the reliability, validity and unidimensionality of all the research survey instruments that will be used in the research. As discussed earlier in section 4.5, this research has chosen the quantitative approach, using survey questionnaires as a data collection method. Thus, issues concerning reliability and validity were considered at an earlier stage, as well as during the design of the research, to ensure that these issues would be processed correctly during the data collection and data analysis phases. Typically, the most essential part of the research data analysis process is the assessment of the survey questionnaires measurement’s validity and reliability. "It is generally accepted that when a concept has been operationally defined, in that a measure of it has been proposed, the ensuring measurement device should be both valid and reliable" (Bryman and Cramer, 2005, p.76). Furthermore, an additional test of unidimensionality needs to be tested with regards to the context of this research in order to assert that all items in the questionnaire measurement constructs have one underlying construct.

In this research, the first step of pre-data analysis was undertaken by transferring the data collected to SPSS (a statistical software tool) in order to analysis the research survey questionnaires and also to test the reliability, validity and unidimensionality. Figure 4-6, presents the hierarchy of pre-data analysis for establishing the reliability validity and unidimensionality of survey questionnaire measurements as a basis for further data analysis processing. During the pre-data analysis process, Cronbach's alpha coefficient was used for testing the reliability, while a factor analysis was used for confirming the construct validity (convergent and discriminant) of all survey questionnaire measurement constructs. In the subsequent sections, the research methods applied in testing the reliability, validity and unidimensionality during the pre-data analysis process phase of this research will be presented.

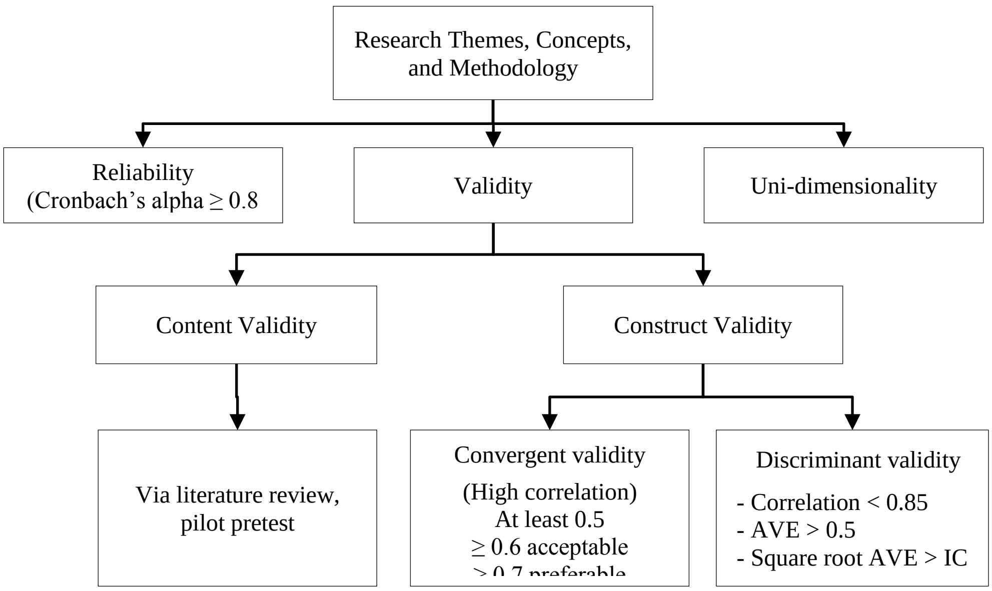

Figure 4-6: Research method hierarchy applied during the pre-data analysis phase of this research

4.10.1.1 Reliability

Reliability analysis is important to assess the research survey questionnaire and to verify the internal consistency of the variables (Chu and Murrmann, 2006). The purpose of reliability analysis is to ensure that the scale used in all the questionnaires consistently measures the questionnaire's variables and that the items are internally consistent in the survey instruments. In reliability analyses, Cronbach's alpha is the most commonly used measurement in related research. To ensure consistency and reliability, theory-based definitions of the integrated virtual enterprise utility management platform (or 'one-stop' model) and user TTF, information system benefits, user intention determinants to accept the innovation, as well as effective means of promoting behavioural intentions towards sustainability were defined and used for each survey question in the questionnaires.

The last questionnaire surveyed the effect of the sustainability-related functionality within the research model on user behavioural intentions towards sustainability. The measurement constructs were adapted from previous studies where the TPB is a widely applied theoretical framework for explaining behaviour and behaviour change at an individual level, as described earlier in Chapter 3. The questionnaire follows the instrumental framework that was initiated by Ajzen (1991) in that it defines the survey measurement constructs based on the TPB in order to explore the extent to which the sustainability related functionality of the research model can promote individual behavioural intentions towards sustainability.

The survey items' internal consistency and reliability for all survey questionnaires of this research were tested by calculating Cronbach's alpha (Nunnally and Bernstein, 1978). Normally, the Cronbach's alpha coefficient value for assisting the assessment of reliability falls in the ranges of 0 to 1, where values closer to 1.0 show more internal consistency than other items on the scale. The minimum sufficient Cronbach's alpha value is 0.6, as suggested by Nunnally and Bernstein (1978).

Similarly, in this study, the reliability of all survey questionnaire items was verified using Cronbach's alpha (Cronbach and Murphy, 1970). Chapter 7 presents the detailed reliability analysis results for the research questionnaire measurements constructs, including the number of items analysed and alpha values obtained in the results. All of the items in the questionnaire were assigned to both the related theories, as measured by TTF, information system success, expected 'net-benefit' outcomes, TAM, DOI, perceived innovation characteristics and TPB constructs. All of the values obtained from the Cronbach's alpha analysis fell in the range of 0.803 to 0.971, demonstrating that all of the items used to measure the different constructs are internally consistent. The reliability analysis results show an acceptable level for all of the variables used in this study (i.e. they were above 0.80). The statistical results provide evidence to the nature that all of the variables used in the questionnaires are significantly reliable, which supports our prior assumptions.

4.10.1.2 Validity

Another important test during the pre-data analysis phase of the research process is to confirm the validity of the questionnaire instrument (Hair, 2010). In general, validity analysis aims to verify that the survey instrument accurately measures what it intends to measure and contains no systematic or random error (Churchill and Iacobucci, 2009). Validity is considered a crucial measure of a questionnaire instrument's correctness (Litwin, 2014). It can show whether the questionnaire items truly measures what it is supposed to measure in accordance with predefined objectives (Oppenheim, 2008, Baines and Chansarkar, 2002, Parasuraman, 2007, Peterson, 2004) While also providing a valid measurement free of systematic or random errors. Generally, the validity of a concept asserts that it is well represented by the survey questionnaire’s measurement constructs. The survey questionnaires for this research study were developed to address issues of validity from an early stage of the research process. The questionnaire instrument is conceptually based on a theoretical framework (presented in Chapter 3) that was carefully defined in order to obtain an effective conceptual model, define the associated variables, and develop relevant questionnaire measurement constructs at the theoretical level. Afterwards, several different approaches were employed to evaluate validity according to the purposes of the measurement and analytical methods that were used. In this research, three types of validity were assessed, as shown in Figure 5-6, which are: content validity; construct validity (discriminant and convergent); and, a test of unidimensionality. These aspects of research validity can be presented as follows.

4.10.1.2.1 Content validity

According to Bohrnstedt (1970, p. 91), content validity is the “degree to which the score or scale being used presents the concept about which generalisations are to be made". It aims to assure that the research concepts that a researcher intended to obtain are appropriately captured by the measurements (Churchill and Iacobucci, 2009, Baines and Chansarkar, 2002). Bryman and Cramer (2005) report that content validity is the minimum requirement that a researcher should consider when testing validity. In this research, content validity was verified using a critical evaluation of the definition of each construct included in the survey by reviewing the theories and research findings relevant to the research framework used in this thesis, including: previous research studying user evaluations of TTF, information system net-benefits, user technology acceptance, perceived characteristics of innovation and the role of technology innovation in promoting individual behavioural intentions towards sustainability. In the survey questionnaires, all the item contents for each construct were adapted from existing scales in the relevant literature. The user evaluation of TTF and technology services adoption was adopted from the similar fields of e-government, e-commerce, and e-banking. Promoting individual sustainable behaviour is adopted from the relevant literature on consumer behavioural change and design interventions that promote household energy and resource consumption reduction. Furthermore, the survey questionnaire measurement constructs and items' content were also tested for content validity by other PhD researchers who work in the same research area of technology adoption and sustainable behaviour change. Therefore, the measurements are believed to have sufficient content validity.

4.10.1.2.2 Construct validity

In general, the aim of the construct validity analysis is to verify that the survey questionnaire instrument accurately measures what it intends to measure. It is specifically concerned with what the instrument construct is measuring. According to Bryman and Cramer (2005), for better construct validity the researcher is recommended to consider obtaining hypotheses and related variables from relevant theories to the research concept. Following this suggestion, the validity of the survey questionnaires for this research was earlier addressed during the design of the survey instrument. Afterwards, a subsequent validity test was carried out during the pre-data analysis phase to determine construct validity issues (including convergent and discriminates validity tests).

The survey questionnaire's *convergent validity*, the TTF, information system net-benefit, TAM, six PCI constructs and behavioural intention towards sustainability measurements (TPB constructs) were evaluated according to their factor loading values using SPSS. The expected outcome of factor loading analysis is a measurement of the strength of the items' relationship with its relevant constructs. Items with a high value of loading indicate a significant correlation of the items with the related constructs that they were loaded with. In this study, the factor loadings for survey questionnaire items were tested in accordance with convergent validity. The items' loading values obtained ranged from 0.607 to 0.908, indicating that almost all of the items were loaded very well with their related construct, which in turn indicates good convergent validity for all items of the questionnaire instruments used in this research.

Having ensured that the instruments meet the necessary level of convergent validly, the researcher then conducts the assessment of discriminant validity of the questionnaires. *Discriminant validity* is used to show that the measurement of interest is not inappropriately related to a measurement of a completely distinct construct (Messsick, 1995). The item's load result should more highly correlate with other items of the same construct rather than with other items of other constructs. Fornell et al. (1982) suggested that the squared correlations between two different measurement constructs must be lower than the variance shared by the measurements of a construct. By adopting this suggestion, the researcher tested the discriminant validity of the study survey questionnaire instruments' items and related constructs. For all of the questionnaires, all of the shared variances between any two constructs were smaller than the amount of variance extracted by one of the two constructs. Therefore, the constructs of the survey instruments for this study had sufficient discriminant validity. Consequently, it could be considered valid for further data analysis to provide accurate answers to research questions with regards the investigation of a user evaluation of the model's net-benefits, TTF, intention to use the innovation and the model's potential effects on their behavioural intention towards sustainability.

4.10.1.3 Unidimensionality

Unidimensionality is typically tested when a survey questionnaire instrument includes measurement items that are inverted from another relevant survey instrument, which comprises the use of multiple items, in which each single item is measuring the same questionnaire construct. In this situation, a unidimensional test of the measurement constructs must be conducted (Hair et al., 2003). Unidimensionality exists when each item is highly related with only one measurement construct (Anderson and Gerbing, 1988, Kline, 2011). It can be assessed by performing exploratory factor analysis (EFA) or confirmatory factor analysis (CFA) (Anderson and Gerbing, 1988, Kline, 2011). This research used EFA to test the survey questionnaire item's unidimensionality. The statistical analysis results are presented in chapter 7.

4.10.2 Test of multicollinearity

With regards to the selection multiple regression analysis as an appropriate statistical analytical method for application in part of the data analysis process of this research, the possibility of the multicollinearity problem was one of the most important issues to be addressed. The Multicollinearity tests can be guided through statistical indicators (p-values). Multicollinearity exists when the overall p-value might be significant but the p-value for each predictor might not be significant and the correlation between the coefficients is very high (i.e. above 0.9). In this study, as shown in Chapter 7, none of the correlation values were above 0.90. The highest squared correlation among the independent variables was 0.19. Thus, none of the squared correlations were close enough to 0.80 to suggest a problem with multicollinearity amongst the research variables (Hair Jr et al., 1995).

4.10.3 The data analysis strategy and selected statistical methods

In the research design of this thesis the strategy of data analysis was conducted across different phases based on a research methodology design that was described in the previous section 4.9. Therefore, the data analysis strategy will be described based on these different phases of the research process, with an emphasis on deciding an appropriate analytical approach that suits every data analysis phase in the process and the type of data collection methods that were used. As stated in section 4.5, this research identified a quantitative approach as the most appropriate data collection method to collect research data from the respondents. Thus, the research strategy for data analysis was based on the quantitative data analysis approach, which typically starts with several pre-analysis steps that must be accomplished in advance of analysing the data. The complete data analysis began after the data was prepared, screened, corrected and assessed for reliability and validity. It was assumed that conducting pre-data analysis at a preliminary stage was a crucial step in the preparation of the data for advanced statistical analysis.

The data analysis strategy was designed based on the research theoretical framework and research design methodology. Accordingly, there are two different phases of data analysis to be carried out to achieve the overall objectives of this research First, the data analysis to evaluate user perceptions of TTF/‘net benefits’ with regards to the innovative technology approach formulated in the research model, including, the data analysis of phase I investigating user perceptions towards the initiation of an integrated virtual enterprise utility management model (namely, perceived TTF and their expectation of its net-benefit outcomes). Second, the data analysis of user acceptance of the research model and their evaluation of the potential effects on their sustainability behaviour. This stage is mainly concerned with conducting the data analysis of phase IV in the research design to validate the research model and examine the potential effects on user technology acceptance in promoting user behavioural intentions towards sustainability.

The *first phase of data analysis*, namely, the pre-data analysis process started with several steps that include data preparation, coding, cleaning, error checking and data transfer to the SPSS analytical tool._Afterwards, the reliability and validity of the research survey questionnaire was tested using the appropriate statistical methods. This was followed by a descriptive analysis to allow generalisations to be formed from participant's information regards to their demographics, familiarity with ICT and Internet services, use of organisational e-services etc. It also includes data analysis to explore the first research questions that are related to the users' perceptions towards the innovativeness of the research model, concerning the TTF, net-benefit outcomes, current and desired status. This was completed by applying different data analytical approaches, such as descriptive, correlation and bivariate analyses. It was identified that such analytical approaches could provide strong evidence about the users' perceptions of the innovation's technology fit and net-benefits of the research model as well as answering the first research question of this research.

The *second phase of data analysis* was aimed towards validating the users' perspectives of technology acceptance, adoption of the research model and the expected influence of the model on individual behavioural intentions towards sustainability. This was carried out through the use of an appropriate analytical framework (as shown in Table 4-4) that examined the user evaluation of the model's effects on technology adoption and towards the fulfilment of one or more sustainability features of the model on promoting individual sustainable behavioural intentions. This was completed by conducting several steps of pre-data analysis similar to those carried out in the first phase of data analysis described earlier and was followed by the application of different data analysis approaches, including, explanatory, correlation and multivariate analysis techniques (read here, multiple regression analysis), to test the research hypotheses. It was also identified that such analytical approaches could provide strong evidence about the users' future acceptance of the Integrated virtual enterprise utility management platform (or the 'one-stop' model), the expected model's influence on promoting individual sustainable behaviour as well as answer the second and third research questions of this research.

These two phases of data analysis involve the selection of several analytical methods to be used in the research's pre-data analysis process, testing of hypotheses, examination of the relationship between model variables and validation of the overall research model. The analytical methods including the statistical techniques employed in this research phases were summarised and shown in Table 4-4.

Table 4-4: Summary of the data analysis statistical methods that were employed in this research (Source: Author)

Data analysis phase	Data Analysis Type	Analytical approach	Analytical method
User evaluation of the model's TTF/'net benefit' outcomes *(Data analysis of research phase I)*	Preliminary data analysis	Multivariate	*Exploratory factor analysis* (Factor analysis, reliability analysis, discriminate validity, construct validity and unidimensionality testing)
	Descriptive /Explanatory data analysis	Univariate	*Descriptive* (frequency distribution, percentage mean and standard deviation)
		Bivariate	Correlation (Pearson correlation coefficient and hypothesis testing)
		Multivariate	*Multiple regression analysis* (hypothesis testing)
The assessment of user technology acceptance of the research model and their evaluation of its effects of their sustainability behaviour *(Data analysis of research phase IV)*	Preliminary data analysis	Multivariate	*Exploratory factor analysis* (Factor analysis, reliability analysis, discriminate validity, construct validity and unidimensionality testing)
	Explanatory data analysis	Multivariate	*Multiple regression analysis* (hypothesis testing)

As shown in the above Table 4-4, several statistical methods were used in the analysis of the data in different phases of the research, including, Exploratory Factor Analysis (EFA), descriptive analysis, Pearson correlation coefficient and multiple regression analysis. The results of the data analysis that made use of these techniques will be presented in Chapter 6 and 7. The following sub-sections provide a description of the statistical methods, which are identified to be the most appropriate techniques for analysing the collected data for each phase of this research, with a description to the underlying reasons for selecting each method.

- EFA

As shown in Table 4-4, the statistical method used for per-data analysis process in phase II and IV of the research methodology's design, was EFA to test the survey questionnaire's reliability and validity. Three common types of analysis techniques are used to test reliability and validity, these are: EFA (Norris and Lecavalier, 2010), Confirmatory Factor Analysis (CFA) (Kline, 2011), and Structural Equation Modelling (SEM) (Fox, 2002). The EFA statistical technique is the most widely used in the analysis of relationships between a large set of variables in terms of a few manageable variables. In the context of this research, EFA was used to test the validity, reliability, and unidimensionality of the research survey questionnaires that were used in different research process phases. The EFA was conducted by using SPSS, Version 20 and the results obtained are illustrated in section 7.2 of chapter 7.

- Descriptive analysis

The descriptive analysis method was employed in this research in phase II of the research methodology design. The approach of this method is to analyse each variable independently and on a one by one basis. According to Malhotra and Birks (2012), descriptive analysis is most suitable for application when there is one measurement item for each variable or when there are multiple items for each variable but they will be analysed independently. Phase II of this research starts with the descriptive analysis in order to build a greater understanding of the overall user characteristics in terms of their demographics, prior-experience of technology, Internet behavioural characteristics, perceptions towards the innovation's TTF and their evaluation of the 'net-benefit' outcomes of using the technology innovation model. The statistics that were applied in this research are the frequencies, percentages, the mean and standard deviation.

- Pearson correlation coefficient analysis method

The Pearson correlation coefficient analysis method is used in phase II of the research methodology design. This type of bivariate analysis method is concerned with examining the relationship between two different variables. Thus, Pearson correlation coefficients were used in this research to investigate the level of association between the innovation characteristics proposed by this research and the user perception of TTF and 'net-benefits'. The large correlation coefficient implies a strong relationship between the two constructs (Hair et al., 2006). This statistical method was also applied in previous studies related to this research context and in particular in the TTF research area (D'Ambra and Rice, 2001, McCarthy, 2002a, D'Ambra and Wilson, 2004, Grossman et al., 2003).

- Multiple linear regression analysis

In the data analysis of the research methodology phase IV, after validating the reliability of the survey questionnaire instrument and the relationship between the measurement constructs, the research hypotheses were tested using a multiple linear regression statistical method. The purpose of regression analysis is to relate a dependent variable to a set of independent variables (Mendenhal and Sincich, 1993). Regression analysis was seen as the most appropriate analytical technique since the goal of this study was to determine the relationship between the user's intentions to use the integrated virtual enterprise utility management model (dependent variable) and the perceived characteristics of innovation (independent variables). To examine the joint impact, a multiple regression analysis was conducted to predict the user's intentions with regards to perceived characteristics of the innovation, to have more understanding into the research model's effect on user perspectives, and as the best statistical tool for predicting future user's technology acceptance.

All the assumptions of multiple linear regression analysis were considered prior to conducting the analysis. The assumptions of multivariate normal distribution, independence of errors and equality of variance were first tested. There were no violations of these assumptions. Furthermore, multicollinearity was not a concern with this data set, as confirmed earlier by the lack of evidence to suggest significant multicollinearity among the research variables.

All of the statistical methods employed in the data analysis of this research were facilitated through the use of SPSS software, which is widely applied as a powerful statistical tool (Field, 2010). SPSS, Version 15 was used to analyse data from all of the survey questionnaires used in this research, confirming that it is a useful tool of data analysis within the different phases of this research.

Chapter 5: Towards a 'user-centric' and integrated virtual enterprise utility management platform

Introduction, The motivation for creating the platform, Present state of eService delivery in utility management, Proposed integrated platform, Featured Technological Charachteristics for the proposed platform

5.1 Introduction

This thesis is concerned with the efforts needed for future paradigms in the design of utility service management functions and the methods of online service delivery to suit all utility stakeholders, including customers. There is a need to reorganize the online services provision and online service delivery method by providing electronic services to benefit all parties. In addition, a focus is required on households' needs, instead of focusing only on the internal needs of existing web-based fragmented online utilities services, as has been the practice so far. This chapter start with highlighting the motivation for the creation of collaborative virtual enterprise platform in utility management domain, followed by addresses the transition in focus from the existing paradigm of service delivery to an approach that targets the benefits, needs, and expectations of householders as well as those of all other concerned parties.

5.2 The motivation for creating the platform

The increased use of Internet-based applications to deliver electronic services, especially in the utilities sector, has had a great impact on customer satisfaction and on the efficiency of service management. Users of electronic services have the convenience of saving effort and time in comparing the features of services or products (Santos, 2003). The exploration of services occurs through technical interfaces, with the absence of face-to-face interaction, in the online environment (Fassnacht and Koese, 2006).

In the context of online utilities, many utilities agencies have worked hard to develop electronic services and interact with their customers using their own websites. The function of these sites is to mediate with the customers, providing places for information acquisition and transactions. In this traditional way, electronic service delivery is seen from the service provider's point of view, meaning that it is an activity undertaken by the service provider to deliver electronic services to their customers. In this situation, the service provider takes the initiative to make electronic services provision available online and accessible by its customers, regardless of any differences in their preferences or demands. In the traditional approach to online utility services, delivery strategies are designed primarily to add value for the service providers, but not necessarily to address the benefits or demand-side of the customers taking into account their perspectives.

Some organizations that play similar roles as online service providers have recently updated their service delivery agendas to focus on users' needs as a crucial success factor for service adoption by paying considerable attention to users' online service acceptance by meeting their expectations. The change in service delivery approaches is essentially emerging from the need to improve various aspects of service diffusion and user adoption. The lack of user service acceptance and low adoption identified in previous studies (Dada, 2006, Chatfield and Alhujran, 2009, Heeks, 2003, Irani and Love, 2013), indicate a need to include users' demands and requirements in the process of designing and delivering services.

In the case of utility service management, stakeholders tend to expect a comprehensive integrated services delivery approach of online integrated services that have the same quality level of services and responsiveness that they generally experience when dealing with these similar online service providers. This can be achieved by shifting the focus of online service delivery in utilities towards the holistic view that can incorporate the utilities stakeholders' perspective to focus more on users' needs as an essential dimension in service acceptance, which can be expected as a result to (i) increase online service adoption and usage, (ii) optimize user impact, and (iii) enhance user acceptance and satisfaction. This is considered a critical step towards providing services that comply effectively with users' demands, and building an online services infrastructure as a medium for interaction among utilities parties, including service provider regulators, users, government agencies, and sustainable communities. It is expected to facilitate superior goals gained from such an environment to achieve the goals of promoting sustainability and saving the environment by providing a means for all parties to cooperate in using utility resources efficiently.

In the present state, technology innovation is more of a demand in organizational strategy than an option (Johnson et al., 2000, Fitzsimmons and Fitzsimmons, 2008). Every year, new services are initiated with a degree of high failure rate for different reasons (Brown and Eisenhardt, 1995, Stevens and Burley, 2003). In some previous initiatives, the reasons for failure stemmed from the differences in perception of service improvements/ innovativeness between the service provider and the customer (e.g., (Alam, 2002, Liljander et al., 2006, Matthing et al., 2004, Zolfagharian and Paswan, 2008)).

In the context of utility services, the perceptual mismatch between the service providers and the customer in the current conventional online service delivery approach agendas might not fit customers' expectations or be consistent with their needs. It might indeed make users more indifferent to the acceptance or the convenience of electronic services provided by utility organizations, which often results in (i) users failing to use the service, (ii) adopt the service, or (iii) be motivated to continue in using such services. At the same time, we can miss the opportunity to provide the various utility stakeholders (citizens, businesses, regulators, etc.) with tangible benefits that potentially arise from an increased take-up of value-added electronic services, taking account of utility service management issues.

The differences in perceptions stem from the dominance of the service providers' perspective toward service innovation, which normally considers shaping their internal processes to be provided to their customers online. From another comprehensive point of view, the main measures of the success of online services delivery for utility management are users' experiences and their actual usage of these services, determined by whether they meet their expectations and achieve satisfaction with online services.

5.3 Present state of eServices in utility management websites

In this context of online service delivery paradigm, the providers are facing challenges in delivering acceptable, useable, and more adaptable public electronic utility services to their customers. The current fragmentation of utility service management processes is likely to make it more difficult for households to pursue their goals of utility management to achieve efficient resource consumption (Chan et al., 2008), while saving energy and costs as these processes are inconsistent and consume both time and effort. Indeed, households might not be satisfied with the results. These are considered the major obstacles facing the functioning of the online management of utility resources and energy / carbon reduction.

In the current situation of web-based utility services available to households, information about their energy usage and expected changes in their resource consumption behaviour are hidden from them. In most cases, they learn about their real consumption only from their bills or meter readings, having no other source of information about their current use of resources. Furthermore, providing statistical information on resource consumption patterns and household energy use behaviour is considered a time-consuming and difficult task to achieve. In some cases, such information is used for the purpose of exploiting natural resources, such as sunlight and wind, as alternative sources of energy, instead of relying solely on the direct use of utility services' resources.

The existing gap lies in the differences in various utility organizations' perspective when developing online services. In the current situation of online utilities, service provision and energy management functions are based on different providers' perspectives and service delivery approaches and priorities, which in turn stem from variations in their goals and strategies as well as their priorities as to the benefits of their service provision. Several reasons are behind the challenges in the existing situation: (i) such challenges stem mainly from the fragmented nature of electronic services, even within individual utility service organizations and departments; (ii) service providers have focused mainly on shifting from traditional means of service delivery to interacting with their customers electronically via the internet. In most cases, this transformation was achieved by shaping their internal processes to electronic means of providing their services, taking a supply-side approach on their main service delivery strategies. In the current situation, for example, the user is often required to deal with multiple utility service providers via different electronic service sources, accessing each service on a different website and by different service presentations, procedures, and methods of accessibility and authentications (Figure 5-1).

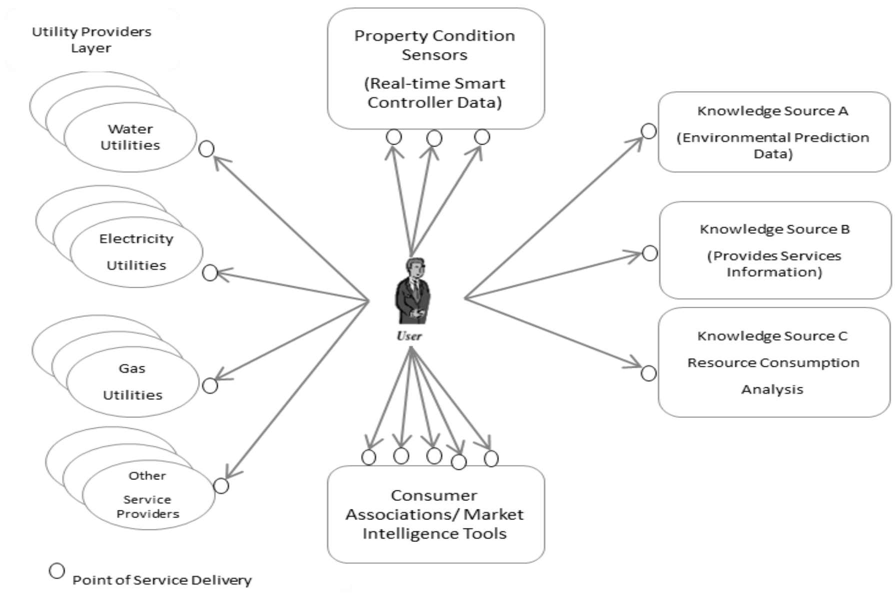

Figure 5-1: Present state of online user interaction to different utility service providers' websites

In such interactions, users are required to deal with distributed sources of information provision and systems to carry out utility service management functions; for example, to perform the task of controlling their property's usage of utility services, they are required to interact with different Internet-based sources of information and, in some cases, use other system interfaces to gather information on the state of the entire property, such as environmental conditions data from real-time monitoring devices (sensors) located on their property. This situation highlights the need for integrated information sources from different systems to be available to users in a comprehensive way. Currently, electronic service delivery provides users with a limited ability to control or gain access to their resource usage data to all utilities on their property. Other utility stakeholders or sustainable communities also have unreliable and inefficient means of electronic infrastructure to facilitate utility users' engagement on sustainability aspects and urge users to efficiently use utility-related natural resources. This situation has arisen because utility service providers are under increasing pressure to align with business competitors by interacting online with their customers simply and efficiently, thereby achieving their goals of saving costs and increasing their revenues while keeping their organization in line with other competitors.

5.4 Proposed integrated utilities management platform

The current electronic service delivery paradigm limits users from benefitting from the use of existing online services because of the increased effort needed to carry out the utility management tasks on their property and the inconvenience of dealing with fragmented electronic services. The problems associated with users' benefits and needs do not usually apply to only a single utility authority or organization. However, the users need to be able to interact electronically with virtual utility service management platform that support the functions of defining user targets as well as manage utility resource use and monitor energy consumption. They also need to have control over resource usage of utility services on their property. To do so, in the present situation, they are required to interact with several information sources via the Internet portals of several utility organizations, which offer fragmented and provider-specific electronic services. In this case, if households want to manage their consumption, they must, for example, interact with several utility organizations to access the various online utility services of their property (Figure 5-1). Such a situation requires different methods of accessibility to different service provider portals to interact with the desirable online utility services provision, which are scattered and in some cases duplicated and usually have different authentication processes as well.

Such obstacles emerge from the absence of a single point of access to knowledge-based information sources that would enable the user to interact with a 'one-stop' online utility management platform that is, a single point of access to utility management services as a source of eServices provision and knowledge-based information repository that can deliver value-added services to households and all utilities stakeholders (Figure 5-2). Such a user-centric and 'integrated virtual enterprise utility management platform (or 'one-stop' service delivery model) can be seen as a comprehensive framework for achieving all parties' goals of saving the environment and supporting sustainability goals related to saving energy and natural resources.

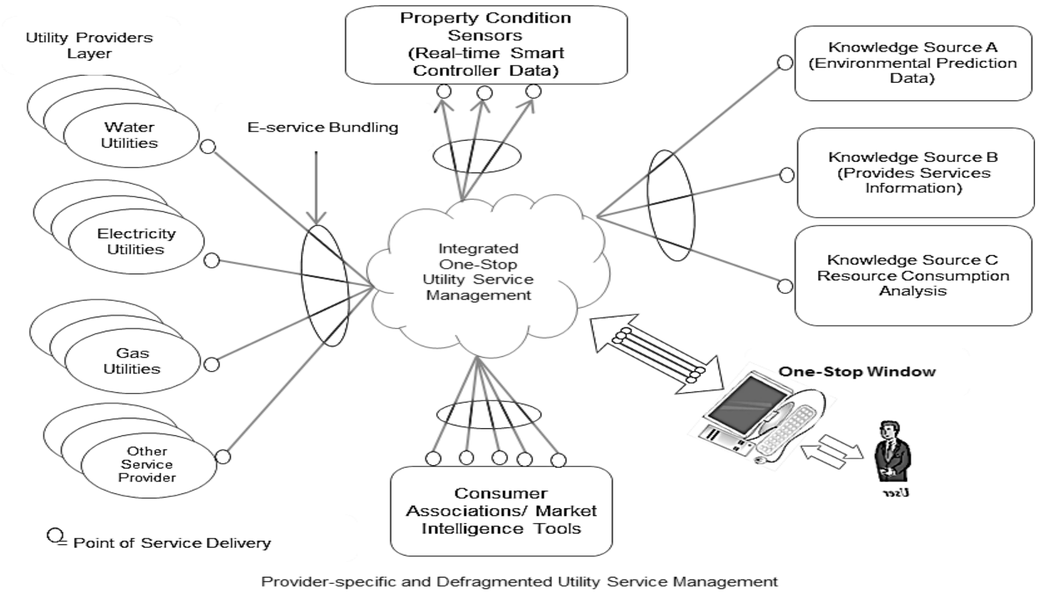

Figure 5-2: Future trends in electronic service delivery strategies in the utilities sector

The earlier description of the 'one-stop' online service delivery platform indicates its important role in, and capability for, creating a virtual delivery environment that enables the elimination of existing boundaries between utility stockholders, including service providers and users, and provides favourable interaction and information sharing between utility parties and sustainable communities, thereby providing comprehensive virtual services that are integrated and directed to users' needs. The emergence of a new kind of electronic virtual environment, offering the innovation of a single point of access to electronic service provisions and information content, can be seen as an effective bridge over the physical and logical boundaries between the organizations themselves and the end users. The desirable features of 'one-stop' integrated utility management platform can include real-time streaming of integrated utility service data from multiple smart controller devices, offering the ability to analyse resource consumption and trigger the user's timeliness with live recommendations related to the issues of energy management, resource consumption, and conservation based on real environmental data and future predictions in some cases.

The initial roadmap for a future user-centric service delivery platform in an 'integrated virtual enterprise utility management environment (or 'one-stop' service delivery model) should aim to overcome the challenges by: (i) factoring different points of view on issues of utility services management and resource consumption, with consideration for the dominant fragmented online utility service provisions; (ii) overcoming the deficiencies of the current service delivery paradigm in providing value-added online services to all utility stakeholders (households, utility service providers, sustainable communities, etc.); (iii) tolerating the limited infrastructure and standardization for sharing consumption or knowledge information in terms of the existence of administrative barriers to information access; and (iv) dealing with the limitations emerging from the defragmented system and operability standards. In some cases, the user is required to interact with distributed sources of information from multiple utility authorities having different technical standards. Thus, integration is essential for building (near) real-time information from different service providers' sources to provide a comprehensive feedback function.

Different components of the user-centric and integrated virtual enterprise utility management innovation platform are essential and can depict how they interact to provide the desired functionality required by all utility stakeholders. The platform is designed to comply with the principles of user-value service provision. A detailed discussion of its components and functionality is provided in the following sub-sections.

5.5 Technological dimension of the proposed model

The following section devoted to highlight the different components of technological aspects that will inform the proposed integrated virtual enterprise utility management platform.

5.5.1 User profiling

One of the major components of the integrated 'one-stop' utility management platform is the utility user profile, which contains information essential to 'one-stop' applications. These user profiles contain personal demographic variables such as age and education, utility-related preferences and goals, and other descriptive information related to utility services account information. They also cover characteristics that influence individuals' behaviours, including social variables, previous experience, available resources, and user lifestyle. This component is therefore expected to include users' characteristic preferences, prior knowledge, activities, behaviours, and utility service targets for the purpose of improving the personalization of information content to match users' needs. It is also desirable to tailor the user interfaces and online service provision from different service providers to suit users' individual preferences. Another profiling service that might be considered for inclusion is information related to tracking users' behaviours, utility-related activity patterns, and feedback on the services. Such data would provide the ability to gain insights into the behaviour of individual users and influence them at the same time. If the 'one-stop' utility management platform has sufficient information about users, then they are more likely to have the chance to accept and adopt the service. The expected functional benefit of using this component is the continued use of online services by utility users. The user profile contains the necessary information that can be used to personalize information content and the online service provision of utility services. It is important to include in the design phase of user profiling the necessary information that will be required later in the personalization process. In the new innovation service delivery approach, both recent design techniques of information profiling and personalization methodologies are required to be incorporated in building a future integrated 'one-stop' utility management platform that focuses on the needs of each user independently.

5.5.2 Virtual provision of integrated electronic services

From the user's perspective (as a public online services user), there is an increased demand to bundle the fragmented online services found in different service agencies, including other corresponding processes, for the benefit of achieving the user's targets for better management of utility services and energy consumption. In this case, all services relevant to a particular situation would need to be linked or integrated into a single service, for example, to ensure that users could access all the utility services they need in one place, regardless of the distribution of competences between the different service provider organizations. This unified entry point or virtual 'one-stop' access represents a kind of comprehensive service provision of all online utility services to the property. Its main goals are to allow users to achieve their goals for monitoring and controlling their utility services efficiently while keeping them aware of what is happening on their property with respect to utilities and resource consumption. This is considered a tangible benefit to the user, in that the use of such tools can participate in supporting them to achieve their consumption targets and improving the efficiency of their use of utility services.

5.5.3 Customization and services personalization

The personalization of services is another important aspect of a successful ‘one-stop’ platform. It is a technique for defining the way of handling the information content and service provision to tailor a better presentation to individual needs. It is commonly used to deliver information and online services that are most relevant to particular users and their interests. Different tangible benefits can be observed from personalizing online information content or services. Some benefits illustrated in the literature (Wu et al., 2003, Hinnant and O'Looney, 2003) are related to reducing the time needed to search for information, simplifying procedures and transactions, and delivering information appropriate to the user. This can augment service use and increase user satisfaction.

The current traditional standard approach followed by utility service providers is to interact with all users in the same way, presenting the same information content to all users regardless of their needs and preferences. This approach fails to recognise that users vary in their goals, their needs, and the ways in which they interact with information or services (Riecken, 2000a). The principle of personalized techniques in the utilities context is required to be more functional to facilitate the delivery of relevant online information to interested users and to raise users’ awareness of available online public services and processes. This personalization process can incorporate a variety of information sources from several utility authorities in order to tailor information contents and services to a particular household. This might include information already in the user profile or explicitly obtained from the user for personalization functions.

In defining the personalization component, it must not be forgotten that the same information content can be interpreted differently according to users’ characteristics. Different interpretations of information content and service provision, in accordance with personal preferences and factors such as age, education, and cognitive styles, will have a major impact on perceived usability, while the personalization of information content and services might influence the level of service adoption by users and provide platform for the users to change their behaviour towards utility resource usage.

5.5.4 Advice and recommendation services

One of the main components of the integrated ‘one-stop’ utility management platform is to predict the information necessary to support users in making decisions on the efficient use of resources provided through utility services. The present state of environmental conditions within the property boundaries and predicted future data are considered essential inputs to the process of utility service management in order to achieve better user control of utility resource consumption. In some predicted situations, the user might have potential opportunities to use alternative (e.g., natural) energy resources as another efficient method of resource conservation.

The user will expect to have active and constant advice regarding current environmental conditions and predicted changes, along with appropriate recommendations in order to, for example, take advantage of weather changes to switch to natural energy sources. It is necessary to design this feature so that it can be embedded within the proposed platform. The design of these services should take account of integration and operability issues to interact with diverse sources of information and prediction services normally provided by several environmental condition advisors. It is essential to design a prediction module within the platform to feed users with useful triggering information, to support users’ ability to control their use of utility services, and to meet their targets of resource conservation and energy saving.

The other main design factor in the recommender component in the integrated ‘one-stop’ utility management innovation is to provide each utility user with personalized recommendations based on user information and resource usage preferences in their predefined profiles. According to (Dezhi, 2003), two techniques support the personalization of such recommendations: (i) collaborative filtering, in which information from users’ profiles (gathered directly from each user or in some cases obtained implicitly from previous interactions and behaviours) will be matched with other service providers or information sources with similar characteristics, and (ii) content filtering, in which the content of existing user profiles and previous interactions and service selection will be used to generate the recommendations.

The recommender component can be designed by blending the two techniques, rather than by using a single filtering method. It is necessary to consider the targeted design criteria and level of personalization required by the recommendation modules according to utility users’ needs.

5.5.5 Information feedback and tailored information delivery

The provision of tailored information by the personalization module will be effective in changing households' perceptions of online utility services and their contents. However, the component requires deep investigation of how information can best be tailored to users' needs. In deciding the method of tailoring information and resource usage feedback, it is essential to consider the use of utility of users' profile information to make appropriate customization/presentation to each user based on his / her prior stored information or interactions with the integrated 'one-stop' utility management platform. The appropriate technique is one that targets the right information content and the provision of electronic services to the user. In the general case, information can be tailored based on users' preferences, behaviours, and resource consumption targets inferred from profiles, such as by personalizing the information to recommend an action plan for controlling energy consumption with regard to predefined targets, with more detailed visual presentation of resource usage for multiple utility services. In this case, only the relevant information content would be presented as required by the user during the information content-tailoring process.

5.5.6 Collaborative and information sharing environment for all utility's parties

The integrated 'one-stop' utility management innovation platform can be seen as a knowledge-based information repository and a real-time communication channel among utility stockholders, including customers, service providers, government, service regulators, and environmental sustainable communities. It will include data from utility service providers, customer characteristics, environmental conditions, predictions, and other useful data related to utility service monitoring and resource consumption control.

As Internet-based interaction is becoming an important part of utility service management practice, some critical design standards should be considered to permit effective knowledge management and information sharing with other utility stakeholders. This includes the possibility of communicating and sharing knowledge via a 'one-stop' communication environment, as a virtual point or medium for exchanging information, which can fundamentally change the ways in which different utility service parties interact. It is essential that the design standard be adapted to the current fragmented nature of utility online services provision and relations among the infrastructure of utility service organizations.

Furthermore, the shift of power to the integrated ‘one-stop’ utility management innovation platform can contribute to creating a channel for the sharing of information between utility service stakeholders, who are considered to be the main players in resource conservation and environment sustainability. Other external parties with an interest in utility services can also benefit from the information-sharing framework to access the knowledge-based information repository, including policymakers or environmental sustainability communities interested in saving resources. In this case, the sharing information and communication component in the ‘one-stop’ innovation offers the ability to share real-time data on utility service information and communicate directly and effectively with other utility parties, as they would also have this proposed type of active communication architecture for sharing utility-related information between all parties, including service providers, customers, and external agencies.

5.6 Platform for promoting pro-environmental sustainability behaviour

When defining the components of the integrated ‘one-stop’ utility management platform for the purpose of online utilities service management, it is important to consider the perspectives of sustainable environmental communities, service regulators, and policymakers when designing the conceptual coverage of the roadmap. Attention should be directed towards providing tangible benefits for all utility service stakeholders, including regulators and policymakers, without compromising the focus of the framework on customers, who are considered major players in energy savings and efficient resource management. This requirement emerges from the fact that user behaviour is now regarded as essential; thus, creating technology platform for promoting pro-environmental sustainability needs to be aligned with users’ actual technology needs and behaviours. Given that achieving the goal of improving the efficiency of energy and resource usage are depends on the actual behaviours of users and how they act with the technology, the interaction with the information technology and its effects on their actual consumption is crucial for future information system development.

Therefore, the proposed user-centric of an ‘integrated virtual enterprise utility management’ platform (or 'one stop' model) is composed of recent technological techniques and characteristics that facilitate the creation of technology innovation that incorporating all utility parties and is capable of providing value-added services that can pave the way in supporting environmental sustainability. This formulation of the innovation technology model should benefit from the characteristics and capabilities of existing information technology (Raven, 1996, Scott, 1998), and from previous researches findings that employs a successful intervention techniques in promoting individual sustainability behaviour.

By reviewing, consolidating and analysing the literature available on the existing intervention techniques to promote individual sustainability behaviour (Abrahamse et al., 2007, McCalley and Midden, 2002, Abrahamse et al., 2005, Loock et al., 2013, Mosher and Desrochers, 2014, Trinh and Jamieson, 2014, Katzev and Johnson, 1983, Bamberg, 2002, Lillemo, 2014, Van Dam et al., 2010, Holmes, 2007, Chen et al ,2014 ,.Schultz et al., 2007, Staats et al., 2004, Dixon et al., 2014, Tran, 2014, Kastner and Matthies, 2014), this study has identified a number of recommended 'sustainability-related functionality' (For example, Goal-setting , Commitment , Comparative Feedback , Recommendation and advices services etc.), that considered as featured functions that will potentially influence the user sustainability behaviour intentions (Table 5-1). Such featured services will be integrated in the proposed model to provide a utility users an up-to-date and efficient solution to facilitate their pro-environmental sustainable behaviour in the future.

Table 5-1: Summary table of featured sustainability-related functions for prompting individual pro-environmental sustainability from related literature

Dimension	Previous Studies References
Goal-setting	Abrahamse et al., 2007, McCalley and Midden, 2002,) Abrahamse et al., 2005, Loock et al., 2013, Mosher and (Desrochers, 2014, Trinh and Jamieson, 2014
Commitment	Katzev and Johnson, 1983, Bamberg, 2002, Lillemo,) (2014, Trinh and Jamieson, 2014
Real-time feedback and demonstration	Van Dam et al., 2010, McCalley and Midden, 2002,) (Holmes, 2007, Chen et al., 2014
Comparative Feedback	Abrahamse et al., 2007, Schultz et al., 2007, Staats et al.,) (2004, Dixon et al., 2014, Tran, 2014
Information (tailoring)	McMakin et al., 2002, Staats et al., 2004, Daamen et al.,) (2001, Abrahamse, 2007a, Shimokawa and Tezuka, 2014
Recommendation and advices services	Staats et al., 2004, Abrahamse et al., 2005, Kastner and) (Matthies, 2014
Rewards and incentives	Winett et al., 1978, Katzev and Johnson, 1984,) (Abrahamse, 2007a, Pothitou et al., 2014
Individualised social marketing, mass media complain	(Steg, 2008, Steg and Vlek, 2009)

5.7 Summary

This chapter has discussed the motivation for the creation of collaborative virtual enterprise platform in utility management domain, followed by addresses the transition in focus from the existing paradigm of service delivery to an approach that targets the benefits, needs, and expectations of householders as well as those of all other concerned parties. It also discussed several aspects related to technology characteristic for building user-centric platform in addition of the suggesting numerous sustainability-related functions that can integrated within the p[proposed platform and can have impact on prompting individual pro-environmental sustainable behaviour. The following chapter will highlight the user perception towards the proposed platform and the associated services delivery approach.

Chapter 6: User perception , technology-fit, and net-benefit analysis

Introduction, descriptive analysis of respondents' sample profile, data analysis findings investigating user perception towards the creation of the proposed platform (includes a both descriptive and advance analysis results) and summary of hypothesis testing results

6.1 Introduction

As has been indicated in Chapter 1, one of the primary goals of this research is the evaluation of user perceptions towards the creation of an 'integrated virtual enterprise utility management' platform (or 'one stop' model), and the associated eService delivery approach within the proposed model. An appropriate theoretical framework and information systems theory was used to identify situations in which a more advanced conceptualisation of integrated services (beyond the basic online services delivery approaches that are commonly employed) is formulated to facilitate user technology satisfaction. The main goal of this chapter is to evaluate user perceptions across all the core components of the conceptual model of the 'integrated virtual enterprise utility management' framework from 'technology-fit' to the expectation of 'net-benefits' with a particular emphasis on the role of TTF on user perceptions of technology innovation benefits. As discussed in Chapter 3, a formulation of the specific theoretical framework was defined in order to investigate users' perception towards the creation of the proposed research technology innovation model. It was a modified theoretical model of a TTF and 'net-benefits' measurements framework, mainly derived from the literature review and to be used to test the user perceptions, and to find an answer to the first research question of this study. The proposed model is based on the important assumption that the user perception of both TTF and 'net benefits' of an integrated virtual enterprise utility management innovation, in terms of user task needs, will have an effect on the utility user perspectives towards the adoption of the technological innovation. Specifically, this chapter aims to answer the first research question (phase I of the theoretical validation framework) by testing the following hypothesis, as formulated earlier in Chapter 3:

<u>Main H.a:</u> The creation of an ‘integrated virtual enterprise utility management’ model, reflected in a ‘one-stop‘ platform, will positively affect users’ engagement with utility services, as well as their overall perception, with a focus on ‘technology-fit’ and ‘net-benefits’.

As stated earlier in the methodology, as outlined in Chapter 4, to achieve the research objectives and answer the research question, the survey was conducted and related data was collected from 1142 people living in the capital city of Saudi Arabia (Riyadh city). Afterwards, the survey data was statistically analysed using different statistical techniques, ranging from simple to advanced analytical methods, to explore, summarise, and interpret the data to understand user perceptions across all related aspects towards the creation of the research technology innovation model and to test the pertaining research hypotheses of phase I of this study.

In the preliminary stage of the data analysis process, a descriptive analysis method as a prevailing statistical analysis was initially used in two parts of data analysis in this chapter. It is used in the first stage of the data analysis to report on descriptive statistics of respondents’ socio-demographic characteristics, their behaviour in using the Internet (prior-experience of the Internet, frequency of internet use, access location and use purposes), and their behaviour in relation to public eService usage (awareness, prior-experience, behaviour and adoption). In addition, it was employed to provide a statistical comparison with the relevant national study of internet user’s characteristics in Saudi Arabia to test the representativeness of study data to the population. It is worth mentioning that it was found to be essential to survey the technological and behavioural context related to the research question and to build a profile of internet-users in a local context before investigating the users’ perception to the creation of a research technology innovation model.

The descriptive analysis also conducted in the second part of this chapter provides a background understanding with regards to user perceptions towards the creation of an ‘integrated virtual enterprise utility management’ framework. It is essential to provide background with valid data to analyse and evaluate the user perception towards the research model as well as to validate the variables that may affect their perspectives towards the proposed technology innovation model. In this situation, sub-section 6.3.1, presents a detailed descriptive analysis of user perceptions towards the task-technology-fit (TTF) and perceived ‘net benefits’ of the proposed research model; whilst analysis results indicating the level of importance of each sustainability-related functionality from the user point view is presented in sub-section 6.3.1.1.2. This section ends with a descriptive analysis summarising the findings obtained from the respondents in relation to their perceptions towards the proposed model.

Afterwards, an advanced (bivariate correlation and multiple linear regression) analysis was conducted to investigate the user perceptions and test the research hypothesis. The data analysis findings and test of the relationship between the research model attributes and user perception of the innovation 'technology-fit' and net-benefits is discussed in detail in section 6.3.2. The advanced statistical analyses of bivariate correlation (Pearson correlation) and multiple regression were used to research the hypothesis and determine the relational effects of the research technology innovation model's dimensions on user perceptions of TTF and 'net benefit'. It is an essential step in the confirmation of the overall user perception in regards to the technology innovation features of the research framework conceptualised in this study, based on their perception of 'task-technology-fit' and the expected 'net-benefit' outcomes.

The final part of this chapter summarises the findings of the data analysis and hypothesis testing results with an aim to developing a more comprehensive, user-centric, integrated and accurate online services delivery model in a utility management context and to present a logical framework that facilitates further development of technology innovation that will be more user adapted.

6.2 Descriptive analysis of respondents' sample profile

This subsection will present the detail of the descriptive analysis results of the respondent's sample profile of this study. It includes a description of respondents socio-demographic characteristics compared with relevant characteristics provided by the national survey of internet users, their internet behaviour (prior-experience of the Internet, frequency of Internet use, access location and use purposes) and their public behaviour in relation to eService use (awareness, prior-experience, behaviour and adoption).

6.2.1 Socio-demographic characteristics

In this section, the respondents' sample socio-demographic characteristics profile is presented. It includes sample gender, age, education, employment type, average monthly income and household family composition and size. Table 6-1 summarizes these characteristics.

Table 6-1: Respondents demographic characteristics profile campared with the national survey of Saudi Internet users (CITC, 2010)

Demographic characteristics	Category	Survey Data (n = 1142)		National survey of Saudi Internet users (n = 2872) (CITC, 2010)	
		Frequency	%	Category	%
Gender	Male	963	84.4	Male	95.3 %
	Female	178	15.6	Female	4.7 %
	Total	1142	100 %	Total	100 %
Age	From 16-19 Years	75	6.6	From 16-19 Years	3.7 %
	20-39 Years	893	78.2	20-39 Years	82.7 %
	40-59 Years	145	12.6	40-60 Years	13.0 %
	60 Years or above	29	2.6	61+ Years	0.3 %
	Total	1142	100 %	Total	100 %
Educational level	Primary School	7	0.6	Elementary to secondary	26.3 %
	Intermediate school	45	3.9		
	Secondary School	166	14.5		
	Sub-total	218	19		
	Diploma/professional degree	164	14.4	High education	73.7 %
	Undergraduate	675	59.2		
	Masters/Ph.D.	72	6.3		
	Sub-total	911	79.9		
	Other	13	1.1	Other	----
	Total	1142	100 %	----	100 %
Occupational	Public sector employee	389	34.1	---	----
	Private sector employee	231	20.2		
	Academic/student	155	13.6		
	Professional	66	5.8		
	Self or unemployed/ retired	213	18.6		
	Others	88	7.7		
	Total	1142	100%		
Average monthly income (KSR)	< SR 0 – 3000	86	7.5	Average Income	13.6 K.SR
	SR 3001 - 5000	147	12.9		
	SR 5001 - 7500	167	14.6		
	SR 7501 - 10000	164	14.4		
	SR 10001 - 12500	242	21.2		
	SR 12501 - 15000	206	18.0		
	SR + 15001	130	11.4		
	Average income (K.SR)	---	10.1-12.5		
	Total	1142	100 %		
Household family composition and size	family with under 16 years	838	73.4	Average household size	6.3 person
	family with adults (age 17-50)	1083	94.8		
	family with age over 50+	459	40.2		
	Average household size	5.8 person			

As indicated in Figure 6-1 (a), analysis of the responses collected shows that the survey sample's *gender* is bias towards males at 84.4%, while only 15.6% of the respondents were female (Figure 6-1 (a)). While these overall gender percentages almost matched the statistics of other national study of Internet-user characteristics in Saudi Arabia (CITC, 2010), the high male response rate obtained in the survey may be explained by the fact that utility services management tasks in Saudi context are commonly handled by males.

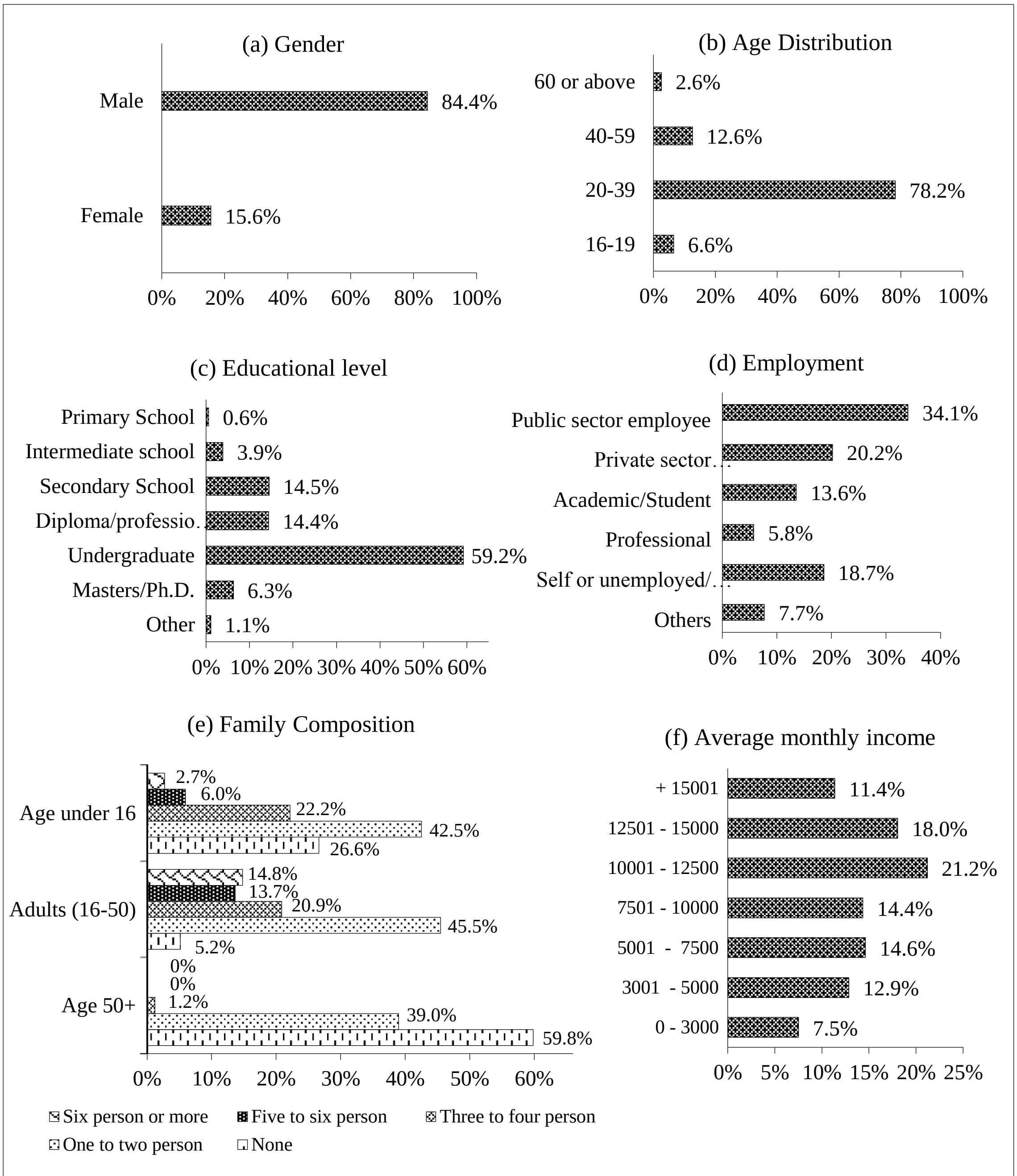

Figure 6-1: Distribution of respondents' demographics characteristics (gender, age, education, occupational, average monthly income, family composition, monthly income) based on a sample of 1142 respondents.

By looking at the latest national statistics about internet-users prepared by the Saudi “Communications and Information Technology Commission” (CITC) in 2010 (CITC, 2010), it can be seen that the total number of Saudi internet-user males exceeds the number of females in the same category (That is a 95.3% male compared to a 4.7% female population surveyed). This is in-line with the findings of previous studies that reveal the existence of a significant gender gap in users' attitudes towards the internet and the use of online services, which can be attributed to several reasons according to Colley and Maltby (2008), (Sorce et al., 2005). Females were reported as most likely to hold negative attitudes towards using computers (Durndell and Thomson, 1997), having higher anxiety (Todman, 2000) and less self-confidence (McIlroy et al., 2001). However, in accordance with the nature of this research, Joines et al. (2003) report that gender differences were becoming less important factors in the prediction of user attitudes towards the use of online services.

The *age distribution* of the respondents shown in Figure 6-1 (b) can be seen as a reflection of the characteristics of Internet users in Saudi Arabia as reported in the national study of the “Communications and Information Technology Commission” (CITC) (CITC, 2010). A large percentage of the respondents (84.8%) belong to of the 16 to 39 years old category, which implies that an overwhelming percentage of the respondents were both internet-user and younger than 40 years old.

A significant variation of percentage and characteristics among different respondents’ age groups was observed. The sample young generation group (16-19) representing 6.6% of the sample population are mostly familiar with computers and Internet and are expected to be skilled in using technology. The following age group of 20-39 years old accounted for 78.2% of the sample. The data analysis shows that the majority of this age group are educated, employed in the public or private sector and have a high rate of Internet access.

Respondents aged between 40 and 60 years old represent 12.6% of the sample. This age segment is considered to have a moderate level of technology usage and noticeably, an increase in technology unawareness is observed as directly proportional to the increase in age among this age group. However, as expected, the remaining age group (60 years old or above) have a low percentage compared to other age groups. Only 29 responses to the survey were from people of age 60 or above, which accounts for 2.6 % of the sample. This age group can be classified as less aware to new technology.

This is supported by previous research that reports that Internet and technology usage will be low among older people (Skok and Ryder, 2004, Welch et al., 2005, Blackburn et al., 2005). In addition, pertaining to the context of familiarity with the Internet, it is widely recognised from the findings of previous studies, that Internet users are more likely to be young people (MiddleEastInternetUserProfile, 2003, InternetWorldStats, 2007). In addition, the survey respondents of this study are only the Internet familiar people from the sample population, which implies that an increased percentage of young people in the sample might be encountered. However, it is worth mentioning here that the age group of 16 or less was excluded from study due to considerations of the nature of the research topic where the utility services management activities are commonly dealt with by elder people.

The *educational level* of respondents was high and consistent with previous studies that identified highly educated people to be expected to have a higher level of internet usage than others. The results shown in Figure 6-1(c) reveal that 59.2% of respondents have a university degree or equivalent and 6.3% have a postgraduate degree, which implies that 65.5% of respondents have at least a university education. A low percentage of 14.4% had a professional diploma, where approximately one-fifth of the sample (18.4%) had basic education of secondary or intermediate level. Only a very low percentage of 0.6% had only a very basic education of primary level, while other education represented 1.1% of the sample.

Based on the sample population of the study, the respondents of the survey were only the people who were familiar with the internet, where they were expected to be more educated (MiddleEastInternetUserProfile, 2003, TheWorldInternetStats, 2008). This evidence is also supported by another study of US Internet users held by (PewInternet, 2007), which found a link between education level and Internet users, where there is high Internet usage among highly educated people at approximately 91% and a low percentage (40%) of Internet usage amongst people having a low educational level. Thus, it was widely recognised that educated people are the most motivated in terms of having internet access and expected to have a greater capacity to use the Internet technology.

The *occupational distribution* of the sample is illustrated in Table 6-1 and Figure 6-1 (d). It shows that the largest two portions of the respondents were of the occupational groups of public sector employee (34.1%) followed by private sector employee (20.2%). Noticeably, *professional employee* had the lowest percentage among the sample survey at 5.8%. This is also in line with the achievements of the development plan report of Saudi ministry of economy and planning development in 2013, which shows that public sector employment was the major occupational category, followed by private sector (MEP, 2013).

The detailed occupational distribution shows that 34.1% of sample respondents are public sector employees, while 20.2% of respondents are private sector employees. Regardless of the fact that the private sector is a large sector in Saudi Arabia, the employment rate is still improving. However, it is notable that the majority of people belonging to the private sector tend to be more skilled in using technology, have better incomes and higher internet access rate. The survey sample also shows that 13.6% of respondents were employees in educational fields (5.4% academic or 8.2% students). The remaining occupational percentage of 18.6% is distributed amongst 3.9% self-employed, 6.4% with no occupation and 8.3% retired people. Figure 6-1 (d) shows the respondents occupational distribution of the sample survey.

The sample average family composition and size is shown in previous Table 6-1 and figure 6-1 (e). The ' *respondents family Composition* in the household was mainly adults (aged from 16 to less than 50 years old), living in the same household of a composite of one to four people at an overall percent 66.4%, while 18.5% were households made up of adults of five people or more. Only 5.2% of respondent results correspond to the family composite with no adults living in the same household. A household of a family composition with an age above 50 mainly pertains to one or two people and makes up 39% of the sample survey. Notably, a low percentage of only 1.2% of family composites with more than two people aged above 50 years old was revealed. The highest percentage of 59.8% from the respondent sample is amongst families without elder members aged 50 or above. This was also compatible with the Saudi national statistical reports which indicates that most population were young with a low percentage of older people within the family composite (CDSI, 2013).

The *average monthly income* of the respondents is shown in Figure 6-1 (f). It presents the average monthly income of the survey sample which can be described in five different income groups. The low monthly income group (0 < 3000 SR) of the respondents accounted for 7.5% of the sample. In contrast, the large income group (10000+ SR) accounted for 50.6% of the sample, which represent the largest percentage obtained among other income groups (See Figure 6-1 (f)). However, the middle range income group (7500+ to 10000 SR) represented 14.4% of the respondents, whilst the other income group of (< 3000 to 7500 SR) was represented by 27.5% of the sample. This implies that most respondents were from the higher income population, which is consistent with the previous studies that reported that internet users were expected to belong to the high income group (West, 2004a, Thomas and Streib, 2003, Edmiston, 2003, Skok and Ryder, 2004, Jaeger and Thompson, 2005, Blackburn et al., 2005, Reddick, 2005).

6.2.2 Demographic sample profile compared with national statistic

The previous section provided detail on the survey sample demographic profile, which included the respondents' gender, age, education level, occupation and average monthly income. As in the last column of Table 6-1, the survey data was also compared with the national study statistical findings of Saudi Internet-users demographic characteristics to ascertain the representativeness of the study sample's population with internet-users characteristics at a national level.

As described in the previous section 6.2.1, the sample demographic profile shows that an average of respondents were males, young and well-educated, public sector employees with a monthly income in the range of 10,000-12,500 SR. The majority of respondents were males (84.4%), aged between 20 and 39 years old (78.2%), at least university education (79.9%) and 73.7% of them were employees (public sector, private sector, academic or professional) or student. 65% of the sample's respondents averaged a monthly income in the range of 10,000-12,500 SR. When comparing the demographic profile of the survey and the national statistical information of internet user demographics (CITC, 2010), the same trend can be observed (Figure 6-2).

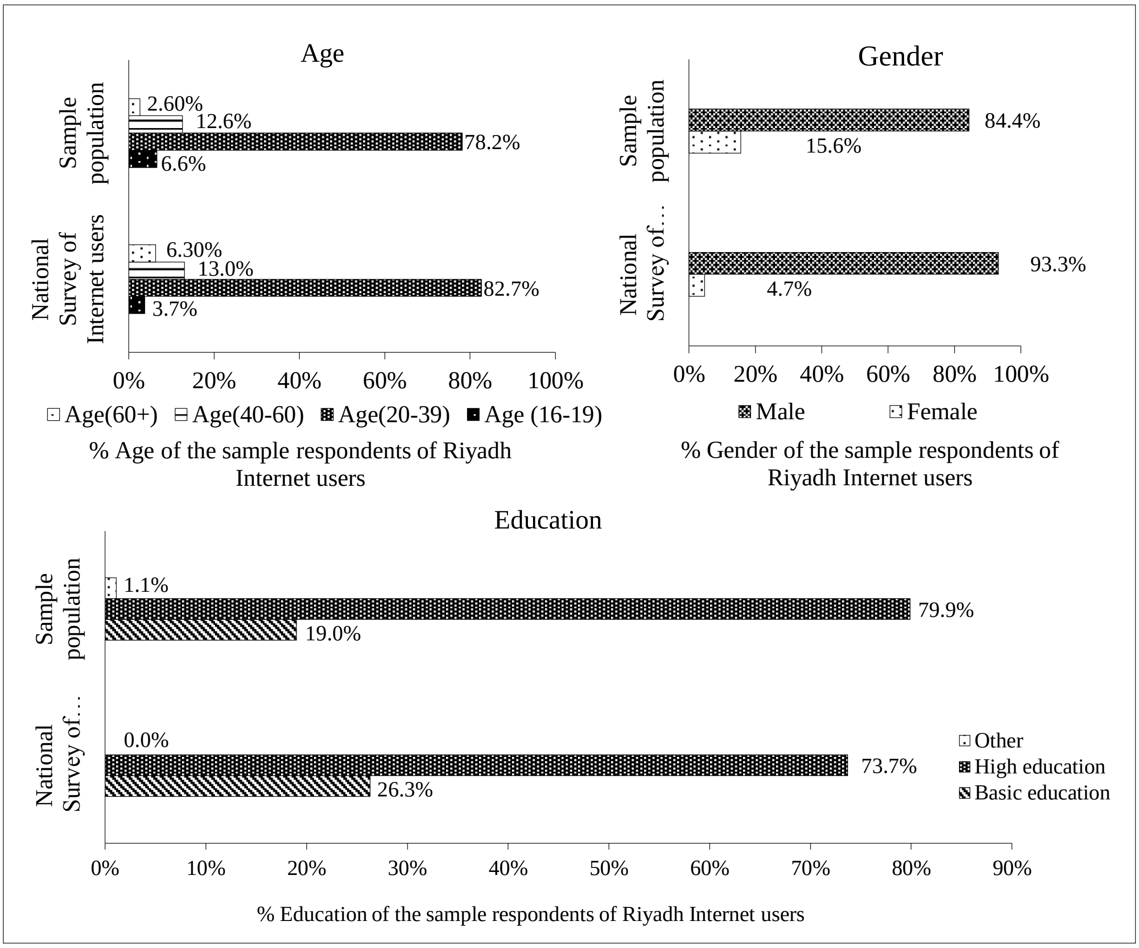

Figure 6-2: Demographic sample profile compared with the national survey of Saudi Internet-users

The results of the demographic characteristics comparison are depicted in Figure 6-2. It shows that the gender distribution was consistent with the national survey of Internet users, where a high percentage of males was identified accounting for 84.4% of the sample compared to 93.3% in the national statistics profile. It shows that the respondents demographic profile obtained from the survey was consistent with the demographic characteristics of the national survey of Saudi Internet users (CITC, 2010).

With regards to the age distribution of the sample, the comparison shows that the percentage of each age group derived from the sample was consistent with the Internet-user age characteristics of the national survey of internet users. The largest age group in the survey sample was that of respondents aged between 20 and 39 years, which represented 78.2% of the sample compared with 82.7% of Saudi internet-users national survey statistics. The percentage of respondents younger than the 40-60 year age group was 12.6% compared to 13% in the national study. The lowest percentile of the study sample was attributed to the elder people of age 60 or more. The overall observation that the majority of the respondents' age in survey sample and the age of those in the national survey of internet-users were under 40 of age was made. (84.8 % of the study sample, compared to 86.4 % in the national survey).

The educational level of the respondents in the sample also closely approximated the education characteristics found in the national survey statistics of Internet-users. (Table 6-1 and Figure 6-2.) The highest percentage of the respondents was educated to a professional level, held a diploma or university degree (79.9% of the current sample and 73.7% in the national survey). This is followed by the people with basic education (primary, intermediate, secondary school), which accounted for 20.1% of the survey sample compared with 26.3% in the national survey statistics. In addition, the high educational level among the Internet users is supported by the prior-research of (Karjaluoto et al., 2002) which reports that Internet users are most likely to be educated and more skilled in using technologies.

In summary, the comparison of the sample demographic characteristics profile with national statistics of Internet users is also consistent with other relevant studies in the same field of information system research. Specifically, it is evident that Internet familiar people tend to be male, younger, more highly educated and with higher income than those unfamiliar with the Internet (West, 2004a, Howard et al., 2001, Thomas and Streib, 2003, Edmiston, 2003, Skok and Ryder, 2004, Jaeger and Thompson, 2005, Blackburn et al., 2005, Welch et al., 2005, Reddick, 2005). Thus, it can be asserted that the sample population of this study is representative of the internet familiar people in Riyadh city, including those who will be questioned to provide more information about their perception towards the creation of the proposed 'integrated virtual enterprise utility management' model.

The following sections will present the sample respondent's characteristics in detail with regards to their familiarity with using the internet and electronic services. Section 6.2.3 will investigate users in terms of how they are familiar with using the internet and what exactly they use the internet for. Section 6.2.4 then provides a description of participants' public eServices-related adoption profile; including their awareness, prior-experience, behavioural characteristics and their current attitude towards eService adoption.

6.2.3 Participants' Internet characteristics

The descriptive data analysis presented in the previous section provides the survey sample data results, which evidently creates an acceptable profile of the respondents, which will be used to achieve the research objectives of this study. It is necessary to mention that only internet familiar people were invited to respond to the survey, where the target sample population, sampling frame, data collection methods were precisely guided by the methodology of this study, which identified Internet familiar people within the framework of the sample as a target population of the study. Following this methodology, this section of the chapter will present the results of the descriptive analysis of internet characteristics of the sample. Table 6-2 shows respondents' internet characteristics and services usage behaviours. This includes their previous internet experience, frequency and average length of use, as well as the purpose of their usage.

Table 6-2: Sample population Internet usage characteristics profile

Characteristics	Dimensions	Sample population (n=1142)	
		Frequency	%
Years of Internet experience	< 1 Year	46	4 %
	1-3 Years	137	12 %
	4-6 Years	354	31 %
	> 7 Years	605	53 %
	Total	1142	100%
Internet Frequency of use	Several times a day	940	82 %
	Once a day	88	7.7 %
	A few times a week	68	6 %
	A few times a month	35	3.1 %
	Once a Month	11	1 %
	Total	1142	100%
Average Length of Use (Weekly)	1-10 hours	200	17.5%
	11-20 hours	198	17.3%
	21-30 hours	186	16.3%
	31 hours +	558	48.9%
Types of use of the Internet	Information Search	1068	93.5 %
	Further Knowledge	1103	96.6 %
	Website browsing	1098	96.1 %
	E-mail	1046	91.6 %
	Chatting	783	68.6 %
	File download	984	86.2 %
	e-banking	717	62.8 %
	e-shopping	532	46.6 %
	e-business	527	46.1 %

As shown in the summarised descriptive data analysis of respondents' internet-related characteristics in Table 6-2, over half of the respondents (53%) had internet experience of seven years or more, while 31% and 12% of the sample had Internet experience of (4-6) and (1-3) years respectively. The least Internet experienced people (of one year or less) accounted for only 4% of the survey sample. The notable high Internet experience among the people surveyed might be a reflection of the fact that internet services were launched in Saudi Arabia some time ago, in 1997 (Al-Tawil, 2001). Thus, it was not unexpected to observe a higher percentage of experienced people in internet technology among the Saudi population.

Looking at the respondents' frequency and length of time using internet services, the statistical information shows that most of the respondents (89.7%) use internet services frequently for reasonable time duration. The survey data analysis indicates that the majority (89.7%) of the sample uses the Internet services on a daily basis, while other frequent use of Internet services have very low percentages. In detail, the responses were 6, 3.1 and 1% for the frequencies of using the internet to the answer of a 'few times a week', 'times a month' and 'once a month', respectively.

Furthermore, the respondents used the Internet services for disparate reasons and activities. To provide information about different internet usage purposes among the sample population, respondents were questioned about their use of the Internet services in relation to their previous usage behaviour of the Internet for information searching, further knowledge, web browsing, e-mailing, chatting, website browsing, file downloading, e-banking, online shopping, trade online and other business purposes (Table 6-2 and Figure 6-3). The descriptive data analysis results indicate that the most dominant use of internet services was for the information services; where 96.1% of respondents use the internet for web browsing, 93.5% for information searching and 96.6% to have gain further knowledge. Other high percentages of internet service usage were attributed to communication via e-mail or file download with an average percentage of 91.6% and 86.2% respectively. However, fewer respondents (30%) used internet services for chatting online.

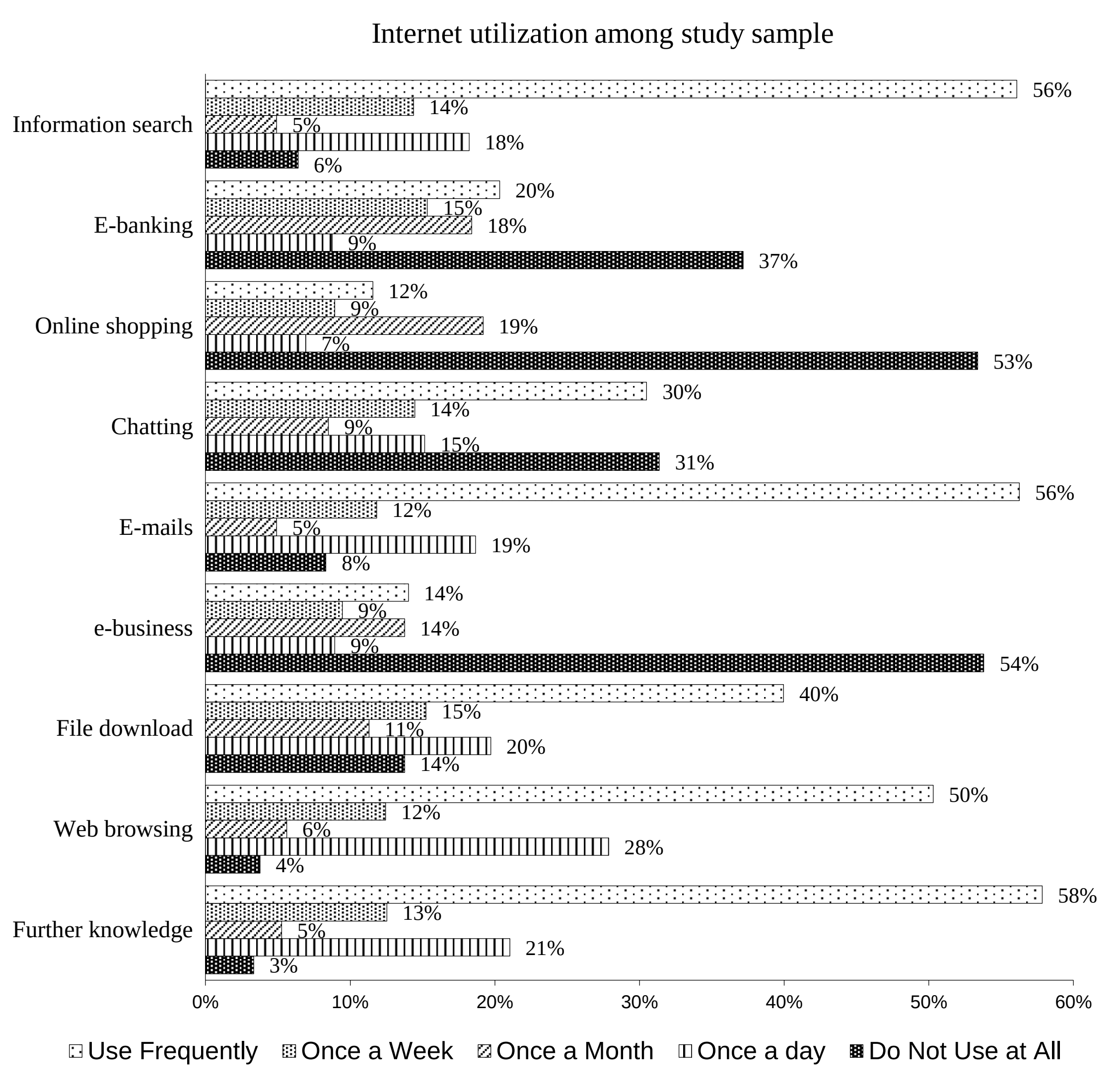

Figure 6-3: Sample respondents' usage types of Internet services

It was noticeable that the smallest percentile for Internet service use was for the purpose of e-banking, e-shopping and e-business, which represent only 62.8%, 46.6% and 46.1% of the sample respectively. This implies that they are less willing to use internet services and they are more conservative in using the Internet for shopping, trade and business purposes. It also indicates that such online services are still growing in Saudi Arabia, similar to the situation in other regional countries (MiddleEastInternetUserProfile, 2003).

To summarize, the descriptive analysis of the sample responses reveals that 89.7% of respondents were accessing Internet services on a daily basis, 6%, a few times a week, 4.1%, a few times or once a month. Almost half of them (53%) have enough prior experience of using the internet (seven years or more), whereas another 31% of the participants' had 4 to 6 years' experience. 12% of those had 1 to 3 years and only 4% have experience of less than one year. The dominant purposes given for use of Internet services among respondents was 'information services' followed by e-mailing and downloading files. The least given use of internet services was for e-banking, shopping or business purposes.

6.2.4 Participants' public eServices adoption profile

6.2.4.1 eServices awareness

In the survey, the respondents were questioned about their awareness and familiarity with existing eServices provided by organisation's websites. An overwhelming number of the respondents (84%) responded that they were aware of the availability of such services; while in contrast only 16% of those respondents stated that they were unaware (Figure 6-4 (a)). In addition, pertaining to eService awareness issues, the majority of the people surveyed had a high awareness of online services provided by utility service organisations. Most of the respondents (75%) responded that they were aware of the existing services provided (Figure 6-4 (b)).

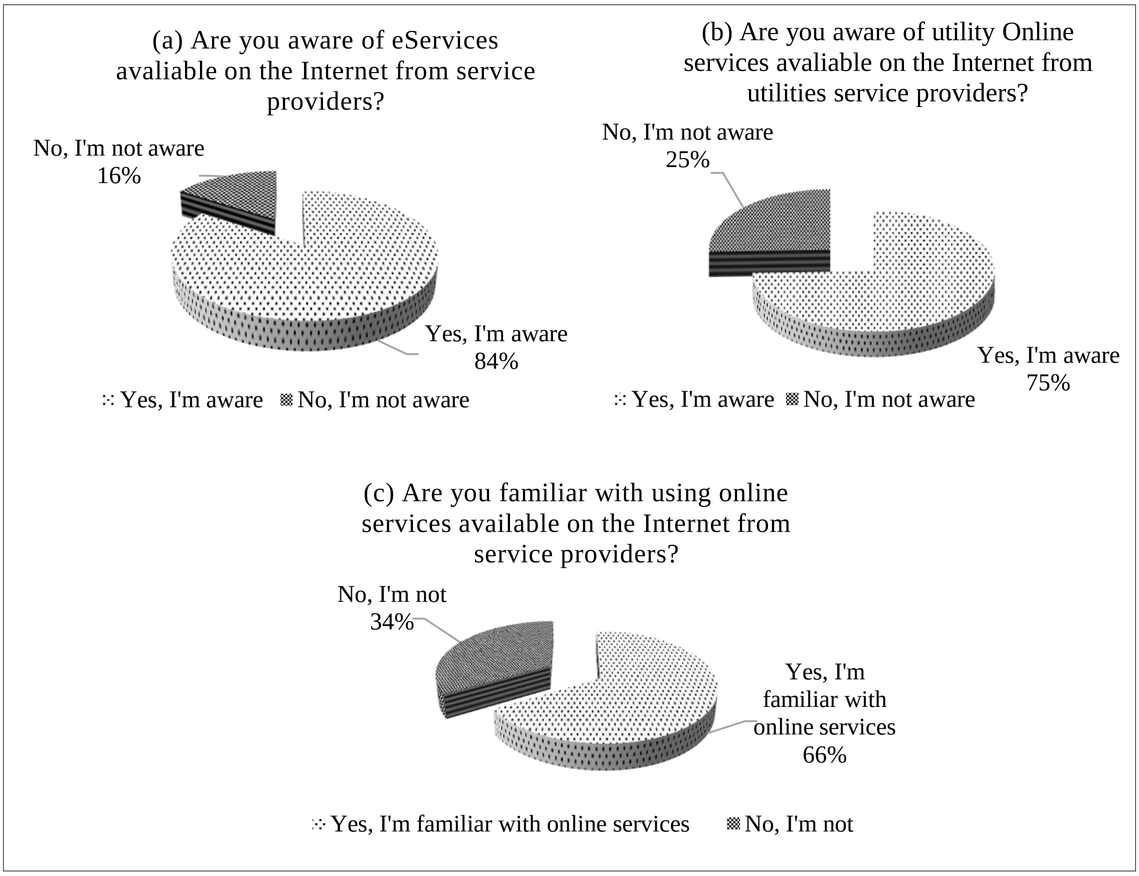

Figure 6-4: User awareness and familiarity with available eService's in Saudi websites

However, one of the main objectives of the Saudi eService's initiatives is to increase the utilisation of the online services by increasing awareness of the initiative, which allows people to be informed about the eServices benefits and continually make them aware of latest services. It is widely recognised that, an increase in awareness of eService's indicates a more positive user willingness to use these services and thus ensures the success of eService initiatives.

As stated in Figure 6-4 (c), the respondents' responses indicate an acceptable level of familiarity with existing eServices provided by organisation's websites. A reasonable percentage (66%) responded that they were familiar with using the eService's websites for information services or for carrying out transactions. However, due to the very few eServices provided on origin websites, a limited number of respondents stated that they try such services to carry out transactional services.

6.2.4.2 eServices prior-experience and behavioural characteristics

This section provides insightful data analysis results for respondents' previous experience and their eService-related behaviour. Table 6-3 shows the different characteristics related to this aspect. Namely, respondent's previous eService experience, frequency of use, type of eService usage (i.e. e-government, e-commerce, e-banking, e-shopping etc.) as well as purposes of use.

Table 6-3: Respondents eService's characteristics profile

Characteristics (N=1142)	Dimension	Sample population (n=1142)	
		Frequency	%
Internet eService's experiences	less than 6 months	49	4.3 %
	6-12 months	131	11.5 %
	1-2 years	206	18 %
	more than 2 years	756	66.2 %
	Total	1142	100 %
Frequency use of eService's	Use frequently	302	26.4 %
	Several times a week	496	43.4 %
	Several times a month	241	21.1 %
	Once a month or less	103	9.0 %
	Do not use at all	302	26.4 %
Internet eService's type (multiple answers)	e-government	508	44.5 %
	e-banking services	750	65.7 %
	e-payment	1003	87.8 %

	e-business/trading /e-shopping	587	51.4 %
	e-travel services	859	75.2 %
	Other online services	249	21.8 %
eService's usage purposes	Informational	865	75.7 %
	Administrative	65	5.7 %
	Transactional	212	18.6 %
	Total	1142	100 %

As shown in Table 6-3, the data analysis findings show that most of the respondents had experience of eServices for at least two years or more, while 18% of the respondents had one to two years of experience, 11.5% of them had experience of between six to twelve months and only 4.3% had less than six months of previous experience of eServices.

The survey data analysis results of the participants' use of available internet eServices during the last six months (Figure 6-5), shows that 26.4% of the respondents use the eServices on a daily basis and 30.1% of the sample use it at least once or many times a month. The largest percentage (43.4%) of the responses stated that they normally use it two to three times a week, while 26.4 % responded that they don't use such services at all.

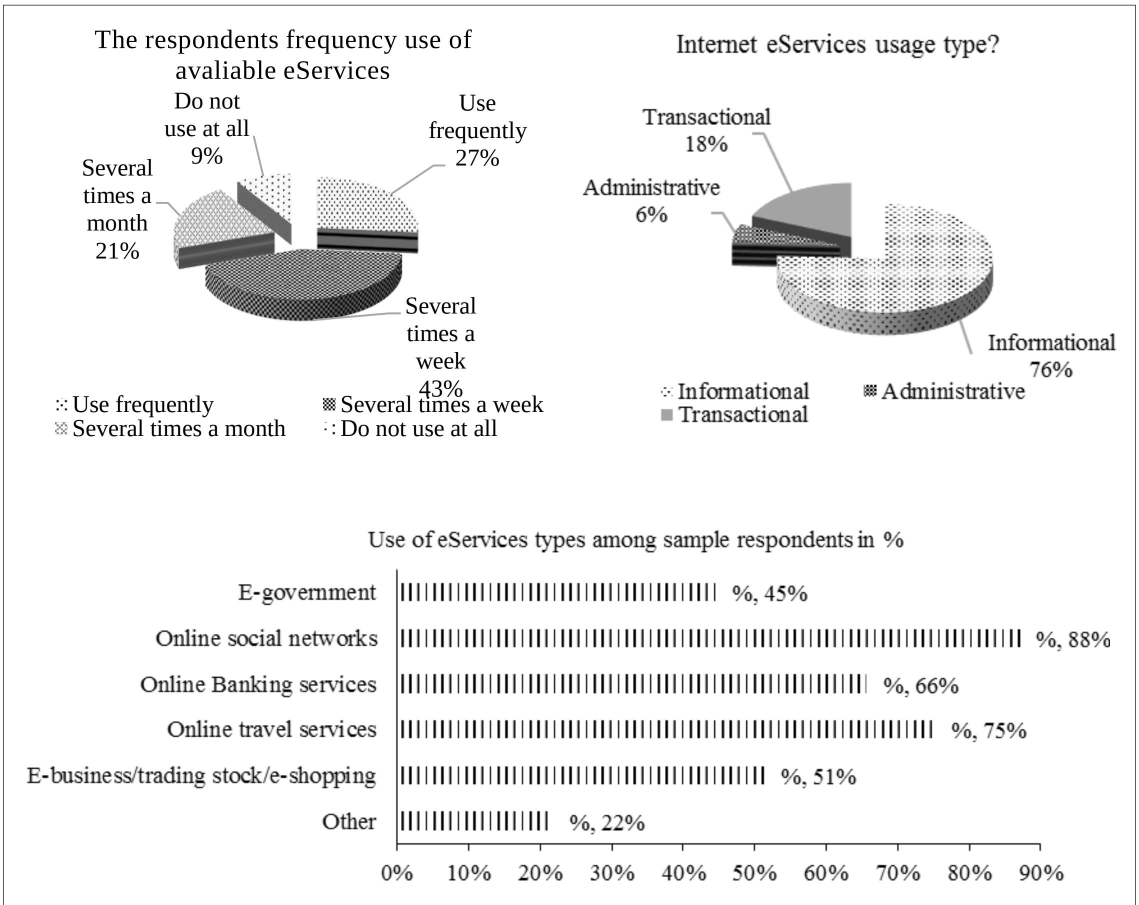

Figure 6-5: Respondents use frequency of existing eService's in organizations websites

Looking at the main eService usage types, the most frequent usage types were the informational and transactional services. They accounted for 75.7% and 18.6% of the sample respectively. The other usage type of internet eServices was for administrative purposes which represented a very low percentage at 5.7% (Figure 6-5). In detail, the majority of eService usage was for e-payments (88%), e-travel services (75%) and e-banking (66%) followed by e-business, e-shopping and online trading, which account for an overall percentage of 51%. Approximately forty-five percent use e-government, while 22% use other types of eService.

In summary, the findings on user behaviour where internet eServices are available, show that the respondents have more than two years of internet eService experience, which supports the expectation that the respondents will be more familiar and comfortable with using the internet eServices in their task activities. This was not unexpected in accordance with the respondents' demographic characteristics profile (in section 6.2.1), which shows that respondents were young, educated, more familiar with internet services and more motivated to use the internet in their everyday activities.

6.2.4.3 Participants' self-report of their behaviour towards public eServices adoption

The previous section presented a summary of the sample's internet usage behaviour, personal experience as well as type of service use and purpose for using. In addition, a data analysis of eService user profile characteristics was made in an attempt to gain a better understanding of the respondents' eService activities which may lead to an explanation of the potential of individual technology acceptance with regards the research adoption model.

As presented in the previous Table 6-3, it was found that the majority of the respondents would use the eService websites for informative services. The data analysis of respondent's behaviour shows that 75.7% of the respondents would use eServices for information services, while, 8.6% will use the eServices to conduct transactions online and a lower percentage of 5.7% will use it for administrative purposes. These findings were in-line with previous studies that suggest that the majority of people will use the eServices that provide information. It was consistent with previous research held in the USA, which reports that the majority of website service usage is to obtain information services (Thomas & Streib, 2003; Welch et al., 2005).

Looking at the respondents' data analysis results, it is clear that a significant percentage of the survey respondents held a positive position regards the use of internet eServices. The results show an average of 80.7% of the respondents having a positive perception of usefulness *(benefits)*' of eServices. 70.1% deemed their tasks '*compatible'* with services provided, 82.8% reported the '*convenience*' of eServices in their activities. 79.2% described themselves as committed to using it and 78% responded that they were *'self-capable'* of using these services. A high percentage of 80.1% of the respondents mentioned that they were '*willing to trust eServices*' provided and 84.8% had an overall positive intention toward using such services. However, the positive perception levels noted amongst the majority of respondents might come as a result of them being skilled in internet services, rather than that the eService delivery approach used by organisations was suited to the user situation. The following Table 6-4 presents the descriptive analysis results of respondent's perceptions toward eService adoption in detail including frequencies, the percentage, the mean values and standard deviation for all survey items.

Table: 6-4 Respondents perception toward eService's adoption

Dimension	Response Scale	Sample population (N = 1142)			
		Frequency	Percent	Mean	Std. Deviation
Perceive Usefulness (Benefits)	Very or somewhat useful	922.0	80.7	2.74	0.93
	Nether useful nor useless	138.0	12.1		
	useless or not useful at all	82.0	7.2		
Self-capability	High	891.0	78.0 %	2.71	0.95
	Medium	172	15.1 %		
	Low	79	6.9 %		
Compatibility	Yes	801.0	70.1 %	1.70	0.46
	No	341.0	29.9 %		
Convenience	High	946	82.8 %	2.80	0.81
	Medium	164	14.4%		
	Low	32	2.8 %		
Willingness to trust eService	Yes	915.0	80.1 %	1.80	0.40
	No	227	19.9 %		

Commitment to use eService's	Most certainly I will use it	440.0	38.5 %	4.11	0.90
	I will use it	464.0	40.7 %		
	I don't know	172.0	15.1 %		
	I will not use it	53.0	4.6 %		
	I will not use it at all	13.0	1.1 %		
Overall intention toward use of eService's	High	969.0	84.8 %	2.82	0.80
	Medium	143	12.5 %		
	Low	30	2.6 %		

With regards to the '*convenience'* and overall perceived benefits of eServices, the survey measured the participants' perception towards the benefits of the internet eServices, by questioning them about their prior experience of using these services or if they held intentions to try to use such eServices on organisations websites. The responses show that that the respondents describe an acceptable level of 'convenience' and 'perceived usefulness' of the services, where the average mean values of measurement items were 2.80 and 2.74 respectively. Also, the highest percentage (80.7%) of the respondents had a positive perception towards the overall benefits of eServices, and a lower percentage of 12.1% were neutral. Only 7.1% stated that such services were useless or not useful at all.

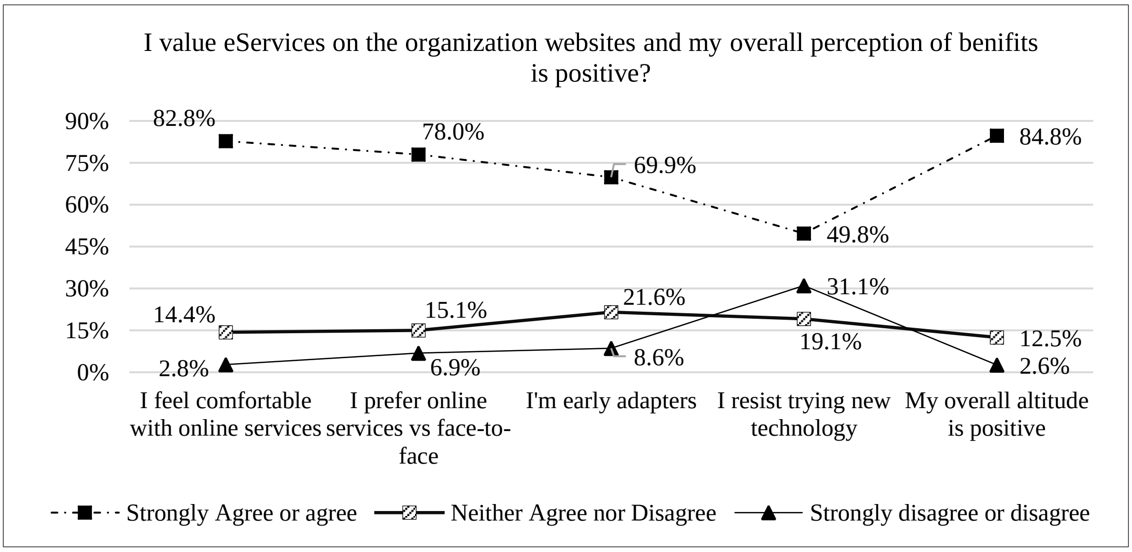

Figure 6-6: User perception toward adoption of eService's provided organizations websites

As shown in Figure 6-6, the results reveal that 82.8% of respondents had a positive perception towards, and feel more comfortable with the use, of eServices to help them in achieving their task activities. Furthermore, 78% prefer online services rather that face-to-face interaction and 69.9% of the respondents self-reported that they will be an early adopter of such services.

The respondent's overall perception of the eService's benefits was highly positive (84.8% of the survey sample). This result was not unexpected since the Saudi internet familiar people are more motivated to use technology and the penetration rate is dramatically increased to reach 54.1% of the population in 2012 compared to 5% in 2001 (CITC, 2012). Referring to the eServices provided online by organisations, the provision of a low level of online services to the user was widely practiced. Specifically, informational services in most cases do not yet meet users' expectations regarding online services. Despite this, 84.8% of the respondents believe that existing eService websites are useful and they have a positive intention toward using it to accomplish their activities. Only 19.1% stated that they have negative perception towards the eServices provided by an organisation on their website.

With regard to respondent's '*perceived self-capability'* in using eServices, as indicated earlier in the internet characteristics profile of the respondents (Table 6-4), the majority or responses (78%) were identified as highly skilled and experienced with internet services and had a significant level of 'self-capability' in using eServices. A low percentage of 15.1% had medium 'self-capability', while only 6.9 % had deficiencies in their capacity to use such services over the internet. However, the survey sample data includes only people who are familiar with internet technology, which implies that all respondents were self-capable of using the internet and to some extent in using the eServices over the internet. However, as described in the respondents sample profile characteristics in section 6.2, most of sample population were highly educated and frequently use the internet and on a daily basis. Thus, to some extent, they were expected to be more self-capable in using eServices as well.

'*Commitment to use eServices*' was questioned on the survey in order to describe the level of respondents' commitment to use eServices. One of the survey items questioned the respondents regarding their potential preference of using eService websites over visiting physical organisations as well as their level of commitment to using such services over the internet. The data analysis results show that 79.2% of the overall respondents stated that they were committed to using the internet and eServices websites for the gathering of information, conducting transactions and for administrative purposes rather than visiting organisation branches in person to receive these services. With regards user commitment, respondents perceived a considerable amount of compatibility (70.1%) during the use of eServices. The above Table 6-4 presents detailed information on compatibility, including the descriptive analysis results providing frequencies, percentage and mean values.

The respondents' '*willingness to trust eServices*', was measured using yes/no questions. The findings show that respondents held an acceptable level of willingness to trust the eServices. An approximate 80.1% of respondents had positive willingness to trust eServices and a lower percentage of 19.9% held negative perceptions in terms of trusting the services provided. Table 6-4 shows the respondents' 'willingness to trust eServices' including, frequencies, percentage, mean values and standard deviation results. It was concluded from the findings that most of the respondents had background information and were familiar with internet services using it for different purposes and able to deal with potential accompanying threats if existent.

As regards to the '*overall intention toward the use of eServices*', the participants self-reported that they generally had a positive behavioural intention towards adopting public eServices. The respondents had significant level of positive perception (97.3%) towards the use of eServices in their everyday activities. However, it was noted that the behavioural intention to use eServices varied in purpose from informative to transactional or even administrative. Furthermore, perceived convenience of eServices had a high positive reception of 97.2% and such a high level was not unexpected because all participants in the survey sample were familiar with internet technologies. They have the necessary skills and capacity to interact with online services with enough self-efficacy (a positive score of 93.1%). It was also perceived to be compatible with their needs as represented by 70.1% of the survey sample. Respondents' willingness to trust eServices had significant positive results, where the results show that the respondents believed that they trusted the services and perceived limited risks with regards using those services.

The respondents overall intention, perception of the convenience and usefulness of eService adoption had a positive value at a composite average of 91.7%. It is noteworthy that the most positive of respondents' perceptions was expected to originate from their previous personal experience rather than from their evaluation of the effectiveness of the available eServices provided in organisation's websites. Furthermore, when measuring respondents' commitment to using eServices, the results showed that, while a large percentage (79.2%) of the sample would prefer to use eServices for interacting with organisations, they actually use traditional methods to gain the services due to the limitations of the eService delivery approach used by the organisations.

6.3 Data analysis results of user perception towards the proposed model

The previous sections have determined the general demographic characteristics of respondents' internet usage patterns, in addition to their eService usage and adoption behaviour. In particular, the sample is representative of people living in Riyadh and familiar with internet technology. The results of the descriptive analysis so far have been based on a demographic profile, characteristics of respondent's internet-related behaviour and their perception regards eService adoption. Since we are in a position to investigate the user perception towards the creation of an 'integrated virtual enterprise utility management' platform (or 'one-stop' model), the aim of this section is mainly devoted to investigating respondent's views to each of the model characteristics using the theoretical framework and model constructs formulated and described in the previous chapter, 3 and shown in Figure 6-7.

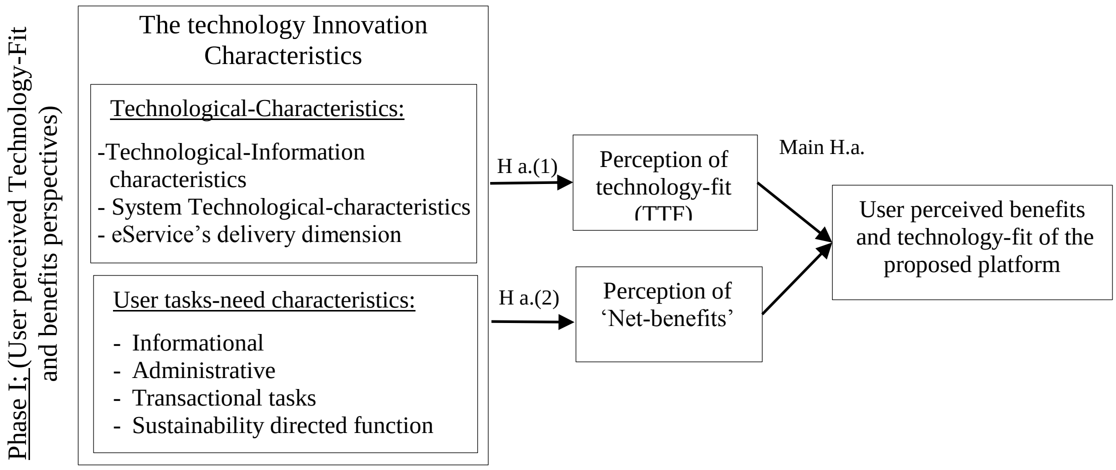

Figure 6-7: Theoretical framework to investigate users' perception of 'technology fit' and 'net-benefit' of the proposed model

The theoretical validation model focus of this research (Figure 6-7) is employed to present the testing results of user benefit perceptions and the technology match between the proposed 'virtual enterprise utility management' model and the user's task needs for managing their utility services online. It will present the test results of both dependent variables of 'technology-fit' and 'net-benefit' as defined in the theoretical model with other independents variables including a function of providing a match between users' task needs and technology innovation capabilities.

The attention is now turned to how respondents answered question in relation to their perception toward the proposed technology innovation model. It includes the user perception of the model's technology fit and their expectation of potential net-benefit outcomes. These include, an investigation of the relationship between the constructs pertaining to independent variables, 'Innovation-technological-characteristics' and user needs or 'task-characteristics with 'TTF' and 'net benefits' as dependent variables.

In the first stage of testing the research hypothesis (main H.a), section 6.3.1 of this chapter, start by conducting a descriptive data analysis in order to describe the respondent's perspective of technology-fit and net-benefits of the research model using the theoretical framework, which is based on the constructs adopted from theories of TTF and the McDeloan information system success construct named 'net-benefits'. This provides a necessary background for further data analysis to follow, answering the research question and testing the hypothesis. Subsequently, in section 6.3.2, for the aims of testing the research hypothesis, the advanced statistical data analysis method (bivariate correlation and multiple regression analysis) was conducted to investigate the relationship between the innovation model's TTF constructs (technological-characteristics and task-characteristics) and the user perception of technology-fit and 'net-benefits', and to achieve the objective of the first part of this research model (phase I). In the last section (section 6.4), the obtained results will be summarised.

6.3.1 Descriptive analysis results

This section is devoted to presenting the findings of the descriptive analysis of the user perceptions of the different facets of the innovation model's TTF, 'net-benefits', and towards the sustainability-related functionality within with the proposed research model. The descriptive analysis starts with an analysis of the respondent's perception of the technology-fit of the proposed model in relation to technology-characteristics and the utility management task-characteristic's dimension. This is followed by section 6.3.1.2, which describes the user perception towards both the 'net-benefits' of the model's outcomes and the initiation of a sustainability-related functionality within the research model. The descriptive analysis findings describe the overall user perception of 'technology-fit' with their task-need and provide a tangible benefit in relation to the utility management context.

The following subsections will represent the descriptive data analysis results obtained from the survey respondents, starting with a descriptive analysis of user perceptions of the ‘technology-fit’ of the technology innovation model proposed in this study, followed by their perception of its potential ‘net-benefit’ outcomes. The data analysis results were obtained using a survey questionnaire, where the participants responded to the questionnaire items, measured using a five-point Likert's scale ranging from "1 = strongly agree" to "5= strongly disagree" except the online sustainability-related functions that range from the least important (1), through neutral (2), to the most important (3). The results of detailed descriptive analysis will be highlighted in the following subsections.

6.3.1.1 User ‘technology-fit’ perspective

This work is focused on the discovery and exploration of user perceptions of fit between the ‘integrated virtual enterprise utility management’ technology innovation characteristics and their needs in terms of utility management tasks. This research describes the user perception of TTF as a precursor to an individuals' innovation usage. It also presents the feasibility and the effectiveness of the proposed model from the end user perspectives of task-technology fit in accordance with the tasks they are trying to accomplish for managing utility services online. The purpose of conducting data analysis in this chapter is to determine how electronic utility services are currently perceived by most individuals today and precisely what task needs and technological variables are impacting their intentions to use such services. It is of prime importance for the researcher to begin evaluating a number of these matters from the perspective of utility users based on the theoretical framework of task-technology fit and net-benefit theories as described in chapter 3. For this reason, the existing study employs the theoretical framework shown in Figure 6-8 to theoretically investigate the utility user’s perceptions of the TTF as a precursor to discovering the variables affecting the use of the proposed innovation of an ‘integrated virtual enterprise utility management’ as well as to provide an understanding of the innovation’s task-technology fit through the user evaluation of technology-fit and motivational features.

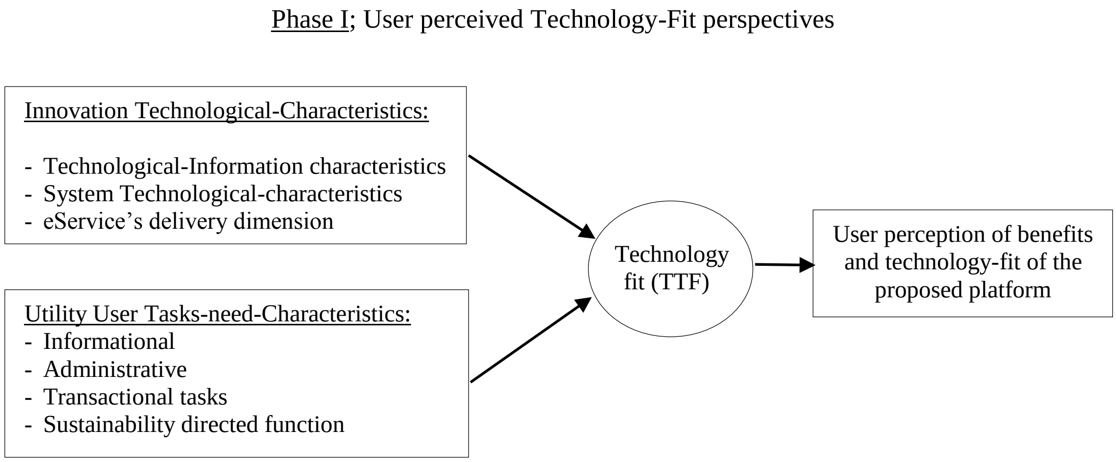

Figure 6-8: Theoretical framework to test user perception of 'technology-fit' of the proposed model in utility management context

The intention is to investigate the user perspective in terms of their assessment of the level of which the proposed technology "fits" with their task needs of managing their utilities effectively. It demonstrates the theoretical basis of the model in order to examine the earliest stated research question and hypothesis of this study.

With respect to this particular fit perspective presented in the theoretical framework in Figure 6-8, the considered approach of TTF is directly concerned with looking at "the extent that technology functionality matches task requirements and individual abilities" (Goodhue, 1995). The technology fit is assumed to be associated with the technology's capabilities, task demands and individual ability, which in turn can predict the impact on resultant user perceptions of technology-fit.

The model for investigating user technology-fit perspectives in this study constitutes a synthesis of two research dimensions identified by Goodhue (1995) and provides pre-technology use attributes that impact the user perspective towards technology-fit. Those aspects are identified as 'innovation-technological-characteristics' and 'task-characteristics', which were suggested as effective measurements of the user technology-fit perspective affecting user intention, specifically at a prior stage of using such technology innovation. The link between fit and 'innovation-technology-characteristics' and utility 'task-characteristics' is initially described using a descriptive statistical method (sections 6.3.1.1.1, and 6.1.1.2), in which the link between perception of fit and the technology innovation model, if existent, is evaluated by the end users who are free of their own accord to assess the technology-fit of such a technology model. Both descriptive analysis (section 6.3.1) and the following bivariate correlation analytical method and multiple regression analysis (section 6.3.2) were used to provide an answer to the first research hypothesis (main H.a and sub-hypothesis H.a. (1 and 2)) formulated previously in Chapter 3,

The following sections (6.3.1.1.1, and 6.3.1.1.2) will provide the detailed and descriptive analytic results of the user perceptions towards the research model in relation to their perceived ‘technology-fit’ of the model in a utility management context. It includes a descriptive analysis of different dimensions of TTF which includes the ‘innovation-technological-characteristic and ‘task-characteristic’ as depicted in Figure 6-8.

6.3.1.1.1 Innovation technological-characteristic

This section will provide the user perception towards the ‘technological-characteristics’ of the proposed model, theoretically defined as the first dimension affecting their perception of ‘technology-fit’. Moreover, it has been previously asserted that the characteristics of information technology have an impact on end user satisfaction. This conclusion is supported by the research of McKinney and Yoon (2002). If the technology innovation characteristics do not fulfil the users’ expected values, that technology will be ignored by the users (Yu et al., 2004). Thus, this study assumes that a utility user perspective of the technology fit of the ‘integrated virtual enterprise utility management’ model is impacted by the technology’s innovation characteristics in addition to other TTF measurement constructs. In the descriptive analysis, the three main measurement dimensions of technological characteristics that will impact an information system’s success as defined by DeLone and McLean were employed in this study, including: i) informational, íí) system and iii) electronic services delivery. As mentioned in chapter 3, the three aspects were modified to suit the definitions of the measurement constructs of technological characteristics in the context of utility management as outlined in the main research model of this study. The different technological innovation characteristics obtained from the literature have been determined and allocated the appropriate measurement of information success in order to formulate the final determinants suitable for application in a user-centric utility management service context. The descriptive analysis results pertaining to the ‘technological-characteristics’ of the proposed model are shown in Table 6-5. It shows the ‘innovation-technological-characteristic’ aspects including a, 1) ‘technological informational dimension’, 2) ‘technological system dimension’ and ‘online services delivery dimension'. All survey items were measured using a five-point Likert-type scale ranging from 'strongly disagree' =1 to 'strongly agree' =5. The following Table shows the detailed descriptive analysis results obtained from survey respondents including their responses to all items, the mean and the standard deviation.

Table 6-5: Detailed descriptive findings of the 'innovation-technological-characteristic' from utility user perspectives

Items	Measurement of user perspective	Response Scale (%) n=1142						
		1 Strongly Disagree	2	3	4	5 Strongly Agree	Mean	SD
Technological information dimension (TINF)								
TINF1	Integrated/shared information environment	0.8	1.2	7.3	40.2	50.5	4.38	0.74
TINF2	Sustainability informative medium	1.6	4.3	9.5	38.6	46	4.23	0.90
TINF3	User-centric information technology	0.2	0.3	11	54.2	34.3	4.22	0.66
Total Average		2.80		9.27	87.9		4.28	0.77
Technological system dimension (TSYS)								
TSYS1	Single windows administration	1	0.8	13.5	48.8	35.9	4.18	0.77
TSYS2	User profiling	1.3	1.6	1.4	58.1	37.6	4.29	0.70
TSYS3	Personalization	0.8	2.8	5.7	39.8	50.9	4.37	0.78
TSYS4	Adaptiveness and user friendliness	0.4	1.2	1.4	68.4	28.6	4.24	0.58
TSYS5	Creativity and innovativeness	2.8	0.5	2.55	56.2	37.95	4.26	0.78
TSYS6	System dynamics and adaptability	0.9	1.6	2.4	54.3	40.8	4.33	0.68
TSYS7	Integration of functionality	1.5	2.9	0.88	59.3	35.42	4.24	0.74
TSYS8	Integrated exchange environment for stakeholders	1.6	0.1	17	53.5	27.8	4.06	0.77
TSYS9	A collaborative virtual enterprise infrastructure	0.1	0.4	7.7	51.6	40.2	4.31	0.64
Total Average		7.43		17.51	91.69		4.25	0.72
Technological online services delivery dimension (TSDY)								
TSDY1	'One-stop' service delivery	2.7	0.5	8.4	38.7	49.7	4.32	0.86
TSDY2	User-centric services	0.6	1.8	23.2	31.9	42.5	4.14	0.88
TSDY3	Integrated portfolio of online services	1.8	0.6	4.9	53.8	38.9	4.27	0.74
TSDY4	Personalized eServices	5.6	2.1	21.18	30.8	40.32	3.98	1.10
TSDY5	Real-time Interactive services	2	1.5	5.4	34.9	56.2	4.42	0.83
TSDY6	Support of sustainability-related services	3.5	0.5	0.1	34.2	61.7	4.50	0.84
TSDY7	Multiple-channel access medium	1.9	0.3	1.8	64.3	31.7	4.24	0.68
Total average		8.47		21.66	87.09		4.27	0.85

The findings from the nineteen items, which measured respondents' perceptions towards the technological characteristics of the proposed innovation model, revealed that there are three measurements that mostly effect user perceptions towards the innovation technology characteristics. The resultant findings are as follows:

I. Technological information dimension (TINF)

A total average of 88% of respondents rated '*technological information dimension*' (TINF) as very likely to be technologically fit with their tasks needs when using the proposed technology innovation mode. (TINF 1, 2 and 3: average mean= 4.28; average SD= 0.77). The detailed measures items reveal that:

- 90.7% believed that the '*integrated shared information environment'* would be an important technological information dimension to be built into the proposed technology innovation model (TINF1: mean=4.38; SD=0.74)
- 84.6% rated the need for technological characteristics of providing a *'sustainability informative medium'* when using online services in the utility management context and highly rate the importance of this technological information dimension being built within the proposed technology innovation model (TINF2: mean=4.23; SD=0.90).
- 88.5% believed that the' *user-centric information technology'* is necessary to be developed into the proposed technology innovation model and such a factor would be a strong technological dimension effecting technology fit from their perspective (TINF3: mean=4.22; SD=0.66).

II. Technological system dimension (TSYS)

A total average of 92% of respondents perceived that the '*technological system dimension'* (TSYS) of the model would be a strong factor affecting 'innovation technological characteristics' that in turn, affects user technology fit perspectives in the context of the research model (TSYS1-9: average mean = 4.25; average SD= 0.72). The detailed measurement items reveal that:

- 84.7% considered a '*single window administration'* as a major technological system dimension that would affect the user perception of the proposed model's technology fit (TSYS1: mean= 4.18; SD=0.77)
- 95.7% of the respondents thought that the use of '*user profiling'* is an important system technological dimension that needs to be considered as for its effect on user perceptions of technology-fit in the proposed model (TSYS2: mean= 4.29; SD= 0.70).
- 90.7% perceived that the use of '*Personalisation'* within the system features might enhance their perception of technology characteristics that are suitable for their demands (TSYS3: mean= 4.37; SD=0.78).

- 97% perceived that the more '*adaptive and user-friendly system' was* the technology characteristic that suited their demands (TSYS4: mean= 4.24; SD=0.58).
- 94.2% perceived that the proposed system's '*creativity and innovativeness'* might have a high impact on their positive perception of technological characteristics of the proposed model (TSYS5: mean= 4.26; SD=0.78).
- 95.2% perceived that '*system dynamics and adaptability'* positively affects their perception of technology characteristics (TSYS6: mean= 4.33; SD=0.68).
- 94.7% perceived the '*Integration of functionality'* of the underlying infrastructure and the system might have a major impact on the development of better technology characteristics (TSYS7: mean= 4.24; SD=0.74).
- 81.3% believed that building a system with an '*integrated exchange environment for stakeholders'* to provide integrated means for the exchange of information and services within the proposed model would be appropriate for integration into the proposed model as an important technological characteristic affecting user technology-fit perspectives (TSYS8: mean= 4.06; SD= 0.77).
- 91.8% believed that building a system that featured a '*collaborative virtual enterprise (VE) infrastructure'* within the proposed model to enable sharing of information and services would be a major factor in their perception of technological characteristics (TSYS9: mean= 4.31; SD= 0.64).

III. Technological online services delivery dimension (TSDY)

A total of 87% perceived that a '*technological online services delivery dimension*' (TSDY) was an important technological characteristic affecting their perception of the suitability of the proposed model with their utility management activity demands. (TSDY1-7: mean= 4.27; SD=0.85). The detailed analysis results of this dimension were:

- 88.4% perceived that the use of a *'one-stop' service delivery'* approach in the development of the proposed technology innovation model will have a positive effect on their perception towards technology characteristics (TSDY1: mean= 4.32; SD=0.86).
- 74.4% believed that a design of '*user-centric services'* in the proposed integrated virtual enterprise utility management model that delivers user-focus services based on personal attributes would affect their perception positively (TSDY2: mean=4.14; SD=0.88).
- 92.7% mentioned that they require an innovation model with technological characteristics that deliver an '*integrated portfolio of online services'* to facilitate their activities of managing their utility services online (TSDY3: mean= 4.27; SD=0.74).
- 71.1% thought that building an innovation technology innovation model with '*personalis[ed] services'* would positively affect their perception of technology characteristics (TSDY4: mean=3.98; SD= 1.1).
- 91.1% perceived that an implementation of 'r*eal-time interactive services'* within the

proposed model would influence their perception towards the advantages of the technological services (TSDY7: mean= 4.42; SD=0.83).

- 95.9% highly agreed that adding the functionality to '*support sustainability-related services'* within the proposed technology innovation model would positively affect their perception towards the technological characteristics of the model (TSDY5: mean=4.50; SD-0.84).
- 96% were highly supportive of the development of a '*multiple-channel access medium*' to enable the user to access electronic services using different means of access (TSDY6: mean=4.24; SD=0.68).

The descriptive results above show that respondents had a high positive perception towards the proposed 'technological-characteristics' of the research model. This is concluded from the higher means yielded from most underlying items of the 'technological information dimension', 'system dimension', and 'online services delivery dimension' as shown in the above Tables 6-5, which provide an indication that the majority of the respondents welcomed the initiation of the proposed 'integrated virtual enterprise utility management platform (or 'one-stop' model) and perceive the technology characteristics fit with their task-needs of managing their utility services online. The findings reveal that 'technological characteristics' seem to have a major impact on influencing positive user perceptions of 'technology-fit'. This finding can be explained by the descriptive analysis of user perceptions towards the different items making up the 'technological-characteristic' dimensions shown in Table 6-5.

When looking at each technology characteristic facet separately, it was found that respondents were most interested in both technological characteristics of the 'informational dimension' and the 'online services delivery dimension' of the proposed model. This is followed by interest in the 'system dimension' (see Table 6-5).

This is in line with the findings of previous studies, where it has been asserted that the characteristics of information technology have an impact on end user satisfaction. This conclusion is supported by the research of McKinney and Yoon (2002). If the technology innovation characteristics do not fulfil the users' expected values, that technology will be ignored by the users (Yu et al., 2004). Thus, this study assumes that a utility user perspective of the technology fit of the 'integrated virtual enterprise utility management' model is impacted by the technology's innovation characteristics in addition to other TTF measure constructs.

6.3.1.1.2 Innovation task-characteristic

As described in section 6.3.1.1, the ‘technology-fit’ theoretical framework shown in Figure 6-8 includes the other constructs named *‘innovation-task-characteristics’*, that affect the user ‘technology-fit’ perspectives towards the proposed model. The descriptive analysis results of perceived ‘innovation-task-characteristics’ as measurement constructs of respondents perception of ‘technology-fit’ is described in Table 6-6.

As previously described in Chapter 3, there are three measurement constructs that were identified to measure the ‘*innovation-task-characteristic*’ dimension in the context of utility services management online. It includes the measurement of ‘informational-tasks’, ‘administrative-tasks’, ‘transactional-tasks’, as well as the functionality tasks of promoting individual sustainability-related behaviour as shown in Table 6-6. All of the items of the three constructs were measured using a five-point Likert-type scale ranging from 'strongly disagree' =1 to 'strongly agree' =5. The following table shows the descriptive analysis results obtained from survey respondents including their responses to the items (those who answered ‘strongly agree’ (5) and ‘agree’ (4)), the mean value and the standard deviation.

Table 6-6: Detailed innovation task characteristic comparison from utility user perspectives

Items	User tasks-need perspective measurement	S.Agree/Agree	Mean	SD
Informational-tasks (TSNF)				
TSNF1	General utility service information	96.9	4.35	0.54
TSNF2	Utility services news and status alerts	80.0	4.08	0.72
TSNF3	Subscription status information	81.6	4.00	0.65
TSNF4	Service regulations updates information	69.4	3.85	0.93
TSNF5	Consumption status information	97.8	4.65	0.55
TSNF6	Avatar informational advices	81.3	3.98	0.72
Total average		84.5	4.15	0.69
Administrative-tasks (TADM)				
TADM1	Access account information	98.7	4.77	0.48
TADM2	Utility subscription and account management	92.6	4.42	0.68
TADM3	Consumptions real-time monitoring, control, and analyses	88.6	4.72	0.71
TADM4	Financial and cost management services	94.4	4.63	0.67
Total average		93.6	4.64	0.64
Transactional-tasks (TRNS)				
TRNS1	Set-up account	99.3	4.52	0.53
TRNS2	Transfer account capabilities	90.9	4.26	0.68
TRNS3	Change tariff scheme of the services	82.5	3.99	0.70
TRNS4	Bill-payment services	99.4	4.87	0.39
TRNS5	Status management of utility services	98.7	4.73	0.55
Total average		94.2	4.47	0.57

The findings of the fifteen-item scale which measured respondents' perception of '*innovation-task-characteristics'* of the proposed innovation model revealed the innovation's capacity to support three task characteristics including, informational, administrative and transactional tasks as the most strongly correlated factors with user positive perception towards the innovation technology characteristics. The descriptive analysis results for these three constructs and the underlying individual items can be described as follows:

I. Informational-tasks (TINF)

A total average of 84.5% were agreed that '*informational-task*' (TINF) characteristics proposed in the research model were suitable for their utility management task-characteristics and therefore it will positively affect their TTF perspective (TINF1-6: average mean= 4.15; average SD=0.69). The detailed item measurements reveal that:

- 96.9% believed that adding a task-characteristic of providing '*general utility service information*' in the proposed 'virtual enterprise utility management model' would have an extreme effect on the' technology-fit' with their task-needs (TINF1: mean=4.35; SD=0.54).
- 80% believed that offering '*utility services news and status alerts*' would make them perceive the proposed model fit with their task-needs (TINF2: mean=4.08; SD=0.72).
- 81.6% preferred to have '*subscription status information*' to make them aware of utility services statuses by integrating such task-characteristics into the proposed model. They deemed that the feature would positively impact their perception of the technology-fit with their task-needs (TINF3: mean=4.00; SD=0.65).
- 69.4% preferred to have new '*service regulations updates information*' and believed that the implementation of such task-characteristics would positively influence their perception of technology-fit (TINF4: mean=3.85; SD=0.93).
- 97.8% believed that offering '*consumption status information*' would make it extremely easy for them to become aware of consumed utility services and that these services would have a major impacts on their perception of TTF (TINF5: mean=4.65; SD=0.55).
- 81.3% state that they mostly welcomed the implementation of '*avatar informational advice*' and such beneficial services would make them positively value the task-characteristics of the innovation (TINF6: mean=3.98; SD=0.72).

Overall, the mean for all items was in the range score of 4.15 which implies that respondents mostly welcomed the proposed task-characteristics and perceived integrating such service dimensions within the proposed model as having a positive effect on their perception of technology-fit.

II. Administrative-tasks (TADM)

A four-item scale measured the constructs of utility user task-needs in terms of '*administrative-tasks*' (TADM). The findings showed that a total average of 93.6% were agreed that TADM characteristics proposed in the research model were suited to their utility management task-characteristics and therefore its integration would positively affect their TTF perspective (TADM1-4: average mean= 4.64; average SD=0.64). The detailed item measurement results were as follows:

- 98.7% believed that adding utility administrative services to '*access account Information*' online would affect their perception towards the model's technology-fit extremely (TADM1: mean=4.77; SD= 0.48).
- 92.6% agreed about the importance of including the '*utility subscription and account management*' administrative task within the proposed model and that it would have positive effects on their TTF perspectives (TADM2: mean=4.42; SD=0.68).
- 88.6% of responses mentioned that they required the technology innovation to include administrative services of '*consumption real-time monitoring, control and analyses*' in the proposed model and that such task-characteristics have important effects on their perception of technology-fit (TADM3: mean=4.72; SD=0.71)
- 94.4% agreed that adding the utility management administration feature to deal with '*financial and cost management services*' in the proposed technology innovation model will enable them to effectively manage their utility services which in turn will positively affect their technology-fit perception (TADM4: mean=4.63; SD=0.67).

The high mean values of all items were observed. All item means were above 3.9, which suggest that in the main, the respondents perceived the proposed TADM as useful task-characteristics to be integrated in the proposed 'integrated virtual enterprise utility management' model. However, the value of the standard deviations for all items indicates that there were limited variances in the respondent's answers. This observation indicates that the respondents seem to have a common positive perception towards the advantages of integrating these TADM characteristics into the proposed model.

III. Transactional-tasks (TRNS)

In the task-characteristic dimension of TTF, the measurement construct of '*transactional-tasks*' (TRNS) was measured by a five-item measurement scale. The descriptive analysis results show that a total average of 94.2% agreed that TRNS characteristics proposed in the research model were suited to their utility management task-needs and would positively affect their perspective towards the TTF innovation (TRNS1-5: average mean= 4.47; average SD=0.57). The detailed item measurement results were as follows:

- An extremely large percent of 99.3% stated they need the transactional services of the type, '*set-up account*' to be included in the future 'integrated virtual enterprise utility management' model and that this would affect their perception of technology-fit (TRNS1: mean=4.52; SD=0.53).
- 90.9% of respondents asserted the need for including the transactional-task of '*transferring account capabilities*' in the future technology innovation model of managing utility services online which in turn positively reflects their technology-fit perception (TRNS2: mean=4.26; SD=0.68).
- 82.5% of respondents mostly agreed on the necessity of the proposed model having within its transactional-tasks, the feature of enabling the user to '*change the tariff scheme of the services'* online and such transactional-tasks had a positive impact on their perception of TTF (TRNS3: mean=3.99; SD=0.70).
- The overwhelming responses of 99.4% agreed on the need for a transactional-task that offered the user the ability to conduct a transaction of online '*bill-payment*' and perceived this task as crucial to their perception of technology-fit (TRNS4: mean=4.87; SD=0.39).
- Similarly, a high percentage of 98.7% perceived the importance of adding the transactional-task that enables users to conduct a transaction for '*status management of utility services*' and consider that feature a critical factors impacting their TTF perspectives (TRNS5: mean=4.73; SD=0.55).

The descriptive analysis results show that the overwhelming majority of the respondent value the 'transactional-tasks' proposed in the 'integrated virtual enterprise utility management' model and they stated that such task-characteristics will positively influence their technology-fit' perception of the proposed model.

IV. Sustainability-related functionality (SUST)

A total average of 88.3% were in agreement on the importance of the '*sustainability-related functionality*' (SUST) being included in the proposed research model as an important task characteristic facilitating their needs of efficient utility management. The descriptive analysis in Table 6-7 presents the respondents perception towards the importance of a sustainability-related functionality, which comprised of ten items including the 'sustainability awareness functions', 'consumption usage feedback', 'usage goal sitting', 'consumption monitoring and control', 'consumption analytical function', 'usage comparative feedback', 'pro-environmental advices and recommendations', 'sustainability engagement campaigns', 'function of link sustainable parties' and the 'sustainable performance labelling and rewards' functions. Respondents answered all the items by ranking each sustainability related function according to their view of the importance of each task-characteristic ranging from the not important (1) to the very important (5).

Table 6-7: Measures of user perception to the importance of the creation of the sustainability-related functionality in the proposed model

Items	Measurement of dimension	Response Scale (%)			Mean	SD
		Not or less Important (1)	Natural	Important or V. important (5)		
SUST1	Sustainability awareness functions	2.5	6.3	91.2	4.43	0.74
SUST2	Consumption usage feedback	0.7	1.5	97.8	4.56	0.58
SUST3	Usage goal sitting	3.5	4.5	92.0	4.58	0.78
SUST4	Consumption monitoring and control	2.0	2.1	95.9	4.83	0.56
SUST5	Consumption analytical functions	3.4	4.9	91.7	4.46	0.82
SUST6	Usage comparative feedback (regional /neighbour)	4.0	10.9	85.0	4.23	0.85
SUST7	Pro-environmental advices and recommendations	6.9	10.6	82.5	4.22	0.90
SUST8	Sustainability engagement functions	11.0	11.2	77.8	4.02	1.05
SUST9	Function of linking sustainability parties	1.8	4.0	94.1	4.67	0.68
SUST10	Sustainable performance labelling and rewards	10.8	14.4	74.9	4.01	1.14
Total average		4.66	7.04	88.3	4.4	0.81

The descriptive analysis results show that the majority of the respondent stated that they perceived that '*sustainability-related functionality*' was an important task-characteristic that required inclusion in the proposed 'integrated virtual enterprise utility management' model and they stated that such a task-characteristic would positively affect their TTF perspective (SUST1-10: average mean= 4.4; average SD=0.81). The results shown in Table 6-7 reveal that:

- 91.2% (answers 4 and 5) of the total sample judges that the introduction of the '*sustainability awareness functions*' in the proposed model is important (SUST1: mean=4.43, SD= 0.74).
- A total of 97.8% of the respondents of the sample judge the adding of a functionality to enable '*consumption usage feedback*' within the sustainability-related functions in the proposed model as very important in affecting their perception towards the model's task-characteristics and technology-fit (SUST2: mean=4.56, SD= 0.58).

- 92.0% of the respondents stated that they judge that the sustainability-related function in the proposed technology innovation model that includes ‘*usage goal setting*’ to allow individuals to control their utility consumption is very important (SUST3: mean=4.58, SD= 0.78).
- A high percentage (95.9%) of the total responses judge that adding the sustainability-related function of ‘*consumption monitoring and control*’ to make the user more aware and able to control their utility resource consumption is important (SUST4: mean=4.83, SD= 0.56).
- A high percentage of the total sample agreed on the importance of the sustainability-related functions of ‘*consumption analytical functions*’ and ‘*usage comparative feedback*’ functions (91.7 and 85.0% respectively) as desirable task-characteristics that would have a major impact on their perception of ‘technology-fit’ (SUST5: mean=4.46, SD= 0.82, SUST6: mean=4.23, SD= 0.85, respectively.
- 82.5% of the total sample stated that they need the sustainability-related functions that provide ‘*pro-environmental advice and recommendations*’ and rank those task-characteristic as important (SUST7: mean=4.22, SD= 0.90).
- 77.8% of the total respondents rank the ‘*sustainability engagement functions*’ as important task-characteristics but at a lower percentage compared to other sustainability-related functionalities in the proposed model (SUST8: mean=4.02, SD= 1.05).
- An average of 94.1% of the total sample believed that adding the ‘*function of linking sustainability parties’* to create a means of online interaction between all utility stockholders to the end of promoting pro-environmental behaviour is of critical importance, influencing their evaluation of the technology-fit (SUST9: mean=4.67, SD= 0.68).
- Lastly, an average of 74.9% of the total respondents mostly welcomed the ‘*sustainable performance labelling and rewards*’ functions within the proposed model to support the initiatives to promote pro-environmental individual sustainability (SUST10: mean=4.01, SD= 1.14).

The findings support the view that the respondents or the current utility customers believe in the importance of the ten task-characteristics of the proposed ‘integrated virtual enterprise utility management’ model in relation to ‘*sustainability-related functionality*’, they especially welcomed the sustainability-related functionality ‘consumption usage feedback’ and ranked the others in terms of importance as, ‘consumption monitoring and control’, ‘function of link sustainable parties’, ‘usage goal sitting’, ‘consumption analytical function’, and ‘sustainability awareness functions’. The functionalities of ‘usage comparative feedback’, ‘pro-environmental advices and recommendations’, ‘sustainability engagement campaigns', and 'sustainable performance labelling and rewards' were the lowest ranking in order.

The findings imply that '*sustainability-related functionality*' as a task-characteristic of the proposed model has a high level of perceived importance, which is reflected by the high value of the mean for all items. This initially descriptive analysis result supports the hypothesis that task-characteristics of the proposed 'integrated virtual enterprise utility management' (including the '*sustainability-related functionality*') were welcomed by utility users and have a positive relationship with their perceived 'technology-fit'.

6.3.1.2 User 'net-benefits' perspective

By referring to the theoretical framework dimensions of 'technology-fit' and 'net-benefits' depicted in Figure 6-7, an answer to phase I of this study can be formulated, since the second aim of prime importance to this research is to begin evaluating a utility user perception towards the potential 'net-benefits' of the proposed 'integrated virtual enterprise utility management' model based on the relationship between the innovation technology characteristics ('technological characteristics' and utility user 'task-characteristics') and user net-benefit perspectives as theoretically defined in Figure 6-9. However, to measure the user 'net benefits' construct, a formulation of an appropriate instrument for 'net-benefits' measurement was defined and underpinned by the prior theoretical framework, as described in Scott et al.'s research (2011). As described in chapter 3, this study differs from that of previous scholars who employed different empirical methods to examine information technology benefits without making any attempt to underpin such a framework theoretically (Torkzadeh and Doll, 1999, Saarinen, 1996, Bonner, 1995, Gable et al., 2008). It uses a well-defined theoretical framework underpinned by the relevant literature to evaluate the user perspective of potential net-benefits of the conceptualised technology innovation model.

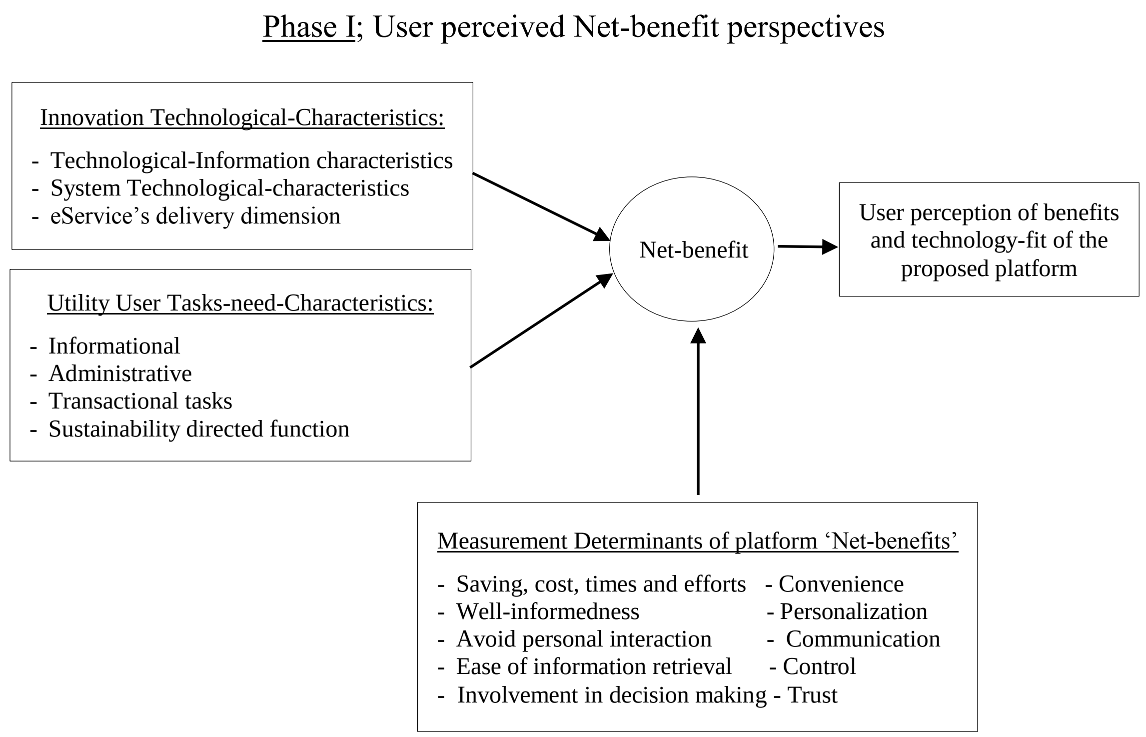

Figure 6-9: Theoretical framework to test the user perception of 'net-benefits' of the creation of a an 'integrated virtual enterprise utility management' model

Following this process, both the survey instrument and data analysis (descriptive and advance statistical analysis) were mainly guided by the theoretical framework in order to explore the effects of the proposed technology innovation characteristics on the user perceived potential 'net-benefit' outcomes, in accordance with the 'net-benefits' measurement dimensions (see Figure 6-9 for details). The dimensions measure the overall focus of user perceptions of 'net-benefits' of the initiation of 'an integrated virtual enterprise utility management' model as conceptualised in this research.

This following section describes the user perception of the model's potential net-benefits based on the descriptive analysis of the survey responses. The descriptive analysis was focused on describing all the measurement items of the 'net-benefits' constructs. Table 6-8 presents the descriptive findings for the nine aspects of the 'net-benefits' of the proposed 'integrated virtual enterprise utility management' model. It includes a description of user perception of convenience, saving (cost, time and efforts), communication and avoidance of personal interaction, control, personalisation, ease of information retrieval, knowledge provision, trust and support in participation of decision making.

All of the items of the 'net-benefits' construct were measured using a five-point Likert-type scale ranging from 'strongly disagree' =1 to 'strongly agree' =5. The following Table shows the descriptive analysis results obtained from survey respondents including their responses to the all items, the mean value and the standard deviation.

Table 6-8: Descriptive findings of user perception of 'net-benefits' of the proposed technology innovation platform (or 'one-stop' model)

Items	Measurement construct of user perceive 'net-benefit' dimension	Response Scale (%) n=1142						
		1 Strongly Disagree	2	3	4	5 Strongly Agree	Mean	SD
NBNF1	Convenience	0.0	0.2	0.5	13.3	86.0	4.85	0.39
NBNF2	Saving cost, time and efforts	0.1	0.2	11.1	10.5	78.1	4.87	0.39
NBNF3	Avoidance of personal interaction	0.2	0.0	0.5	1.9	97.4	4.96	0.26
NBNF4	Communication	0.4	0.4	12.0	42.4	44.8	4.31	0.72
NBNF5	Control	0.6	0.8	8.5	38.4	51.8	4.40	0.73
NBNF6	Personalization	0.3	1.4	10.3	45.3	42.7	4.29	0.73
NBNF7	Ease of information retrieval	0.9	1.0	6.0	22.2	69.9	4.59	0.73
NBNF8	Well-informedness	0.2	0.6	6.2	19.4	73.6	4.66	0.64
NBNF9	Trust	1.1	11.6	20.8	38.7	27.8	3.80	1.01
NBNF10	Participate in decision making	0.6	1.8	23.1	45.6	28.8	4.00	0.81
Total average		2.15		28.4	87.8		4.45	0.66

The findings from the ten-items which measured respondents' perception towards the potential 'net-benefits' of the innovation-characteristics of the proposed model revealed that an overall average of 87.8% of the respondents welcomed the initiation of an 'integrated virtual enterprise utility management' model in a utility management context and expected a high 'net-benefit' outcome of using it in future. The detailed descriptive results of all measurement items of 'net-benefit' constructs are as follows:

- A typical percentage (99.3%) of the respondents stated that the innovation characteristics of the proposed technology innovation model would render them more '*convenienced*' by the technology for managing their utility services over the Internet (NBNF1: mean=4.85; SD=0.39).
- A total of 88.6 % agreed with the proposed technology characteristics and believed that such innovations would allow them to have more control over '*saving their time, cost and efforts*' (NBNF2: mean=4.78; average SD=0.39).
- An average of 93.3% of the respondents perceived the proposed model as facilitating their task need of '*communication*' with different utility parties and they preferred such

a technology innovation framework to '*avoid personal interaction*' with service providers and other utilities parties (NBNF3 and 4: average mean=4.64; average SD=0.49).

- 90.2% of the respondents perceived the 'net-benefits' of the proposed technology innovation framework because it would allow them to have more '*control*' over their utility resource consumption (NBNF5: mean=4.40; SD=0.73).
- 88% of respondents preferred the technology innovation services to be personalised in accordance with their personal attributes and strongly believed that '*personalisation*' of online services in the proposed model would positively affect their perception of net-benefit outcomes (NBNF6: mean=4.29; SD=0.73).
- A large percentage (92.1%) answered that they welcomed the technology innovation model where they would have services with more '*ease of information retrieval*' (NBNF7: mean=4.59; SD=0.73).
- 93% stated that the proposed technology innovation model would be highly beneficial to them, where it makes them more informed and knowledgeable about utility services and their resource consumption status (the '*well-informed*' measurement item; NBNF8 mean=4.66; SD=0.64).
- A reasonable percentage of 66.5% of the respondents reported that they would '*trust*' such a technology innovation model (NBNF9: mean=3.8; SD=1.1).
- Lastly, two-thirds (74.4%) of respondents believed that the proposed technology innovation would enable them to '*participate in decision making*' regards issues of saving on natural resource consumption or other decisions in relation to utility services (NBNF10: mean=4.00; SD=0.81).

The high average mean value of the measurement construct of 'net-benefits', showed that an overwhelming amount of the respondents welcomed the creation of an 'integrated virtual enterprise utility management' model and they are agreed on the remarkable promising benefits that it would provide. In fact, more than 87.8% of respondents strongly agreed or agreed to its potential net-benefit (an approximately 4.45 total average mean point of scale). This evidence is further supported by the descriptive analysis results in the above Table 6-8, which shows that all items had high mean values of 3.8 or above, which implies that the majority of respondents were generally very optimistic towards the promising 'net-benefits' of the proposed technology innovation.

6.3.2 Advanced analysis of user perception towards the proposed model

In the previous section 6.3.1, a descriptive analysis was presented to describe the respondent's perception of 'technology-fit' and 'net-benefits' of the research model in relation to the model's attributes, in order to provide a necessary background for further data analysis to answer the research question and test the hypothesis. Two analytical approaches have been used to test the research hypothesis. The first approach included using bivariate correlation statistical methods to explore the relations between all independent variables of the proposed model's dimensions and the dependent variables of user perception of 'technology-fit' and 'net-benefits'. The second approach was the employment of an advanced statistical data analysis method of multiple regression analysis to test the research hypothesises (main H.a, H.a (1), H.a (2)) and to achieve the first objective of this research (phase I). To test the research hypothesis (main H.a), a regression analysis was conducted to discover the relationship between the independent variables of 'technology-fit' and 'net-benefits' and the 'user's overall perception' as a dependent variable. Other sub-hypotheses (H.a (1), H.a (2)) tested the relationship between all independent variables of the proposed model and the two dependent variables of 'technology-fit' and 'net-benefits' separately, based on the theoretical framework of TTF that entirely focuses on the dimensions of the innovation technological-characteristics and task-characteristics. The following sections will describe the data analysis findings in detail.

6.3.2.1 Testing user perception with bivariate correlation

The bivariate correlations were used to explore the strength of the relationship between the model's variables. Generally, the bivariate correlations test the associations between several variables in order to identify the strength and direction of the relationship between a pair of variables. In this research the Pearson correlation was carried out on different variables of the model and their significant positive correlation was observed. The correlation analysis results for all variables are presented in Table 6-9. It shows the correlation between all the independent variables of innovation characteristics of the integrated utility management model and the dependent variables of 'technology-fit' and 'net-benefit'.

Table 6-9: Bivariate correlation analysis results of all independent variables with 'user perception of 'technology-fit' (TTF) and 'net-benefit' (the dependent variables)

Independent variables	Code	No. Items	Dependent variable: Task-technology-Fit (TTF)	Dependent variable: 'Net-benefit'
Innovation technological characteristic (ITCH)				
Technological information dimension	TINF	Pearson Correlation	.724 (**)	.808 (*)
		Sig. (2-tailed)	0.007	0.025
Technological system dimension	TSYS	Pearson Correlation	.561 (*)	.638 (**)
		Sig. (2-tailed)	0.034	0.010
Technological online services delivery dimension	TSDY	Pearson Correlation	.885 (**)	.920 (**)
		Sig. (2-tailed)	0.001	0.003
Innovation Task Characteristic (ITSK)				
Informational-tasks	TSNF	Pearson Correlation	.921 (**)	.985 (**)
		Sig. (2-tailed)	0.009	0.002
Administrative-tasks	TADM	Pearson Correlation	.898 (**)	.923 (*)
		Sig. (2-tailed)	0.000	0.031
Transactional-tasks	TRNS	Pearson Correlation	.766 (**)	.830 (**)
		Sig. (2-tailed)	0.003	0.000
Sustainability-related functionality	SUST	Pearson Correlation	.902 (**)	.891 (**)
		Sig. (2-tailed)	0.002	0.004
** Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed)				

The correlation of independent variables varied from moderate to a strong positive relation with the dependent variables of 'technology-fit' and 'net-benefits' based on the rule suggested by (Fink, 1995). The results revealed that there is a strong positive relationship between the dependent variables ('technology-fit' and 'net-benefit') and the proposed model's 'technological-characteristic' dimension (the independent variables of ITCH). These variables were, 'technological informational dimension' (TINF) and an 'online services delivery dimension' (TSDY). A similarly strong positive relation was observed with the proposed model's 'innovation-task-characteristic' dimension (independent valuables of ITSK), including the variables of, 'informational-tasks' (TSNF), 'administrative-tasks' (TADM), 'transactional-tasks' (TRNS), and 'sustainability-related functionality' (SUST). However, the 'technological system dimension' (TSYS) scored a significantly moderate positive correlation with the dependent variables. The overall results indicate that there is a strong positive relationship between the technology innovation characteristics of an 'integrated virtual enterprise utility management' model and the user perception of technology-fit and net-benefit of the proposed model. As the purpose of the correlation analysis was to reveal only the existence (or not) of a relationship (strength and direction) between the different variables of the model as a preliminary step for further analysis. The following section, will present an insight information about further advance analysis investigating results in detail.

6.3.2.2 Testing the user perception with regression analysis

To provide an answer to the research hypothesis, the data was analysed using an advanced analytical method that employed multiple linear regression analysis. The regression analysis was seen as the most appropriate analytical technique since the goal of this study was to determine the relationship between user perceptions (as a dependent variable) and all the variables of technology innovation characteristics (‘technological-characteristics’ and ‘user-task-need characteristics’) of the proposed integrated virtual enterprise utility management model (independent variables) as depicted in previous Figure 6-7. The aim is to relate a dependent variable to a set of independent variables (Mendenhal and Sincich, 1993). To examine the joint impact, a multiple regression analysis was conducted to predict the user’s intentions with regards to perceived characteristics of the innovation, to have more understanding into the research model’s effect on user perspectives, and as the best statistical tool for predicting future user’s technology acceptance. For illustration, regression analysis is conducted in order to explore the fit between the ‘integrated virtual enterprise utility management’ technology innovation characteristics and the user task needs from the user perspective. The intention is to investigate the user perspective in terms of his / her assessment of the potential benefit in addition to the level of which that technology “fits” with his / her task needs of managing their utilities services online. The investigation of user perceptions of ‘technology-fit’ and ‘net-benefits’ are based on a TTF theoretical framework which, synthesises two research dimensions as identified by Goodhue (1995). All independent variables of the two dimensions of innovation characteristics in TTF (‘technological- characteristics’ and ‘task-characteristics’) were tested in relation to its effects on the two dependent variables of TTF and ‘net-benefit’ independently. The findings of the regression analysis indicate that there is significant positive strong relation between all independent variables and the user perception of ‘technology-fit’ and ‘net-benefit’ in relation to the proposed ‘integrated virtual enterprise utility management’ model. Table 6-10 shows the regression analysis results for all variables and the next sections will present a discussion of the analysis findings.

Table 6-10: Regression analysis results of all independent variables with 'user perception of 'technology-fit' (TTF) and 'net-benefit' (the dependent variables)

Code	Independent variables	Dependent variables					
		'Technology-fit' (TTF)			'Net-benefit'		
		β coefficient	t-statistic	Significant level	β coefficient	t-statistic	Significant level
Innovation technological-Characteristic (ITCH)							
TINF	Technological information dimension	0.724	4.430	0.007	0.808	2.170	0.025
TSYS	Technological system dimension	0.561	3.168	0.034	0.638	1.129	0.010
TSDY	Technological online services delivery dimension	0.885	3.614	0.001	0.920	3.027	0.003
Innovation Task-Characteristic (ITSK)							
TSNF	Informational-tasks	0.921	3.102	0.009	0.985	0.308	0.002
TADM	Administrative-tasks	0.898	1.771	0.000	0.923	2.011	0.031
TRNS	Transactional-tasks	0.766	1.610	0.003	0.930	3.331	0.000
SUST	Sustainability-related functionality	0.903	0.797	0.031	0.894	1.082	0.007

Dependent variables:
- 'Technology-fit' (TTF); $R^2 = 0.787$; F = 0.014; Sig. = 0.003
- 'Net-benefit'; $R^2 = 0.810$; F = 0.023; Sig. = 0.001

6.3.2.2.1 Testing user perception of 'technology-fit'; as dependent variable

According to the first part of this study (phase I), one of the research objectives was to explain the user perception towards the proposed model from the user 'technology-fit' perspective. It aims to provide an understanding of how the model technologically fits with the user's task needs. The user perception of 'technology-fit' as a dependent variable was analysed in relation to all independents variables in Table 6-10. The regression analysis results show that the innovation's 'technological-characteristic' variables of both TINF and TSDY have a strong positive relationship with user perceptions of 'technology-fit' (0.724, p=0.007 and, 0.885, p=0.001 respectively), which is in agreement with research on electronic eServices, which asserts the role of technological characteristics in affecting user perceptions (Kankanhalli et al., 2005b, Kankanhalli et al., 2005a). Furthermore, the 'innovation-task-characteristic' variables of TSNF, TADM, TRNS and SUST show another strong degree of positive relationship with user perceptions of 'technology-fit' (0.921, p=0.009, 0.898, p=0.000, 0.766, p=0.003 and 0.903, p=0.031 respectively). This again is in agreement with research findings on user perception towards the adoption of new technological services from the TTF perspectives as presented in the literature review in chapter 3. Past research studies on TTF that investigate the impact of 'innovation task characteristics' on user perceptions of technology-fit when adopting new technologies presented common results. These studies indicate the significantly positive relationship between these two variables as depicted in Figure 6-10.

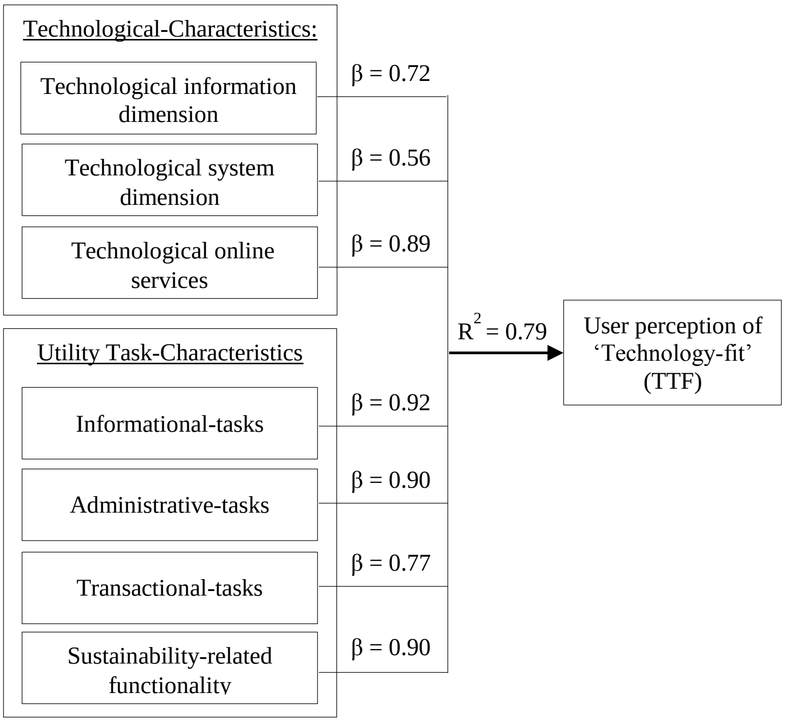

Figure 6-10: Regression analysis results of user perception of 'technology-fit'

As show in Figure 6-10, it is interesting to notice that there is a moderate positive relation between TSYS and the dependent variable user perception of 'technology-fit', (0.561, p=034) which was thought to be strong but seems not to live up to its expected strength. The regression analysis results have not shown a strong relationship between these variables as compared with other variables. A logical explanation for this is that the improvement in technological characteristics of system attributes does not necessary imply a more positive user perception of the innovation's technology-fit. The possible reason for this is that a user might be more interested in the outcome gained from the technology innovation rather than having an interest in technical specifications of the system.

6.3.2.2.2 Testing user perception of 'net-benefits'; as dependent variable

The second objective of the first part of this study (phase I) was to explain the user perception towards the proposed model from the user benefit perspective. It aims to provide an understanding of how the model's technological attributes will have influence on the utility user perception towards the benefits of the 'integrated virtual enterprise utility management' model.

The user perception of 'net-benefits' as a dependent variable was analysed in relation to all independent variables and shown in Table 6-10. The regression analysis results indicate the existence of a highly strong positive relationship between the two independent variables pertaining to 'innovation-technological characteristics' (including, TINF and TSDY) and 'net-benefits' as a dependent variable (0.808, p=0.025 and, 0.920, p=0.003 respectively). In addition, other strong positive relationships were obtained between the 'net-benefits' and the three independent variables that pertain to 'innovation-task-characteristics'; namely, TSNF, TADM TRNS, SUST with beta coefficient results (0.985, p=0.002, 0.923, p=0.031, 0.830 p=0.000 and 0.894 p=0.007 respectively). However, unlike other 'technological-characteristic' dimensions, the regression analysis results show that 'system technological characteristics' (TSYS) have a moderate positive relationship with the user perception of 'net benefit' dependent variables (0.638, p=0.010) (Figure 6-10).

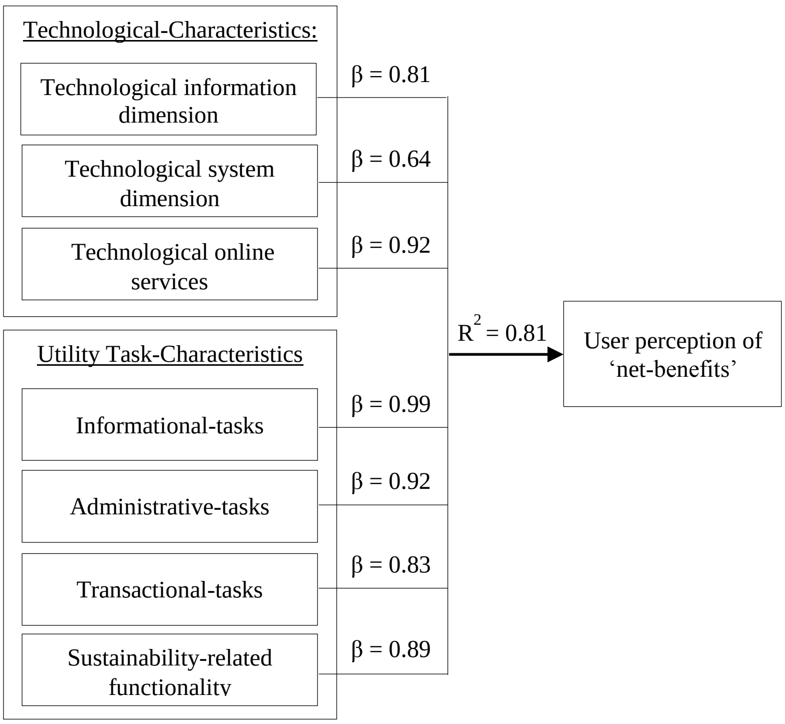

Figure 6-11: Regression analysis results of user perception of 'net-benefits'

However, a significantly moderate correlation exists between the 'technological-system dimensions' (TSYS) and the user perception of 'net-benefits'. This finding does not seem to be in agreement with research on technology adoption and TTF research as specified in the literature where earlier researchers found that TSYS had a strong positive influence on user perceptions of technology-fit, adoption intention and the perceived value of the information system. In contrast, this study found that TSYS does not exert the same strong level of influence on the user perception towards the value of new technology innovation.

The overall significant levels of the independent variables as displayed in the above Table 6-10 (and depicted in Figure 6-11) are quite strong which subsequently provide a solid contribution in explaining the formation of the factors affecting respondents' positive perceptions towards the benefits of new technology innovation. The results indicate that there is a significantly strong positive relationship between all the independent variables and the user perception of 'net-benefits' of the proposed 'integrated virtual enterprise utility management' model. The positive influence of the improvement in 'technological-characteristics' on user perceptions of the technology's value (or its benefits) is supported by other related studies in TTF and technology adoption. The same type of strong correlation was observed between both variables of the innovation's perceived 'technological-characteristic's, its perceived 'task-characteristics' and the users positive perception of the benefit outcomes which is also supported by previous literature of technology adoption and TTF research.

6.4 Summary of hypothesis testing results

To examine the joint impact, a regression analysis was conducted to test the user's overall perception towards the proposed 'integrated virtual enterprise utility management' platform (or 'one-stop' model) and to investigate which independent variable positively affect the user's perception. The regression analysis results are shown in Table 6-11, that presents the relationship between the overall user perception and the two independent variables ('technology-fit', 'net-benefit'). Table 6-11 presents the beta coefficient, which indicates the individual contributions of each independent variable to the model. The beta values of all variables were positive, showing their significant individual contributions in bringing change to the dependent variable.

Table 6-11: Regression analysis results Independent variables effects on user overall perception towards the ‘integrated virtual enterprise utility management innovation’ model

Code	Independent variables	β coefficient	t-statistic	Significant level
TINF	Technology-fit	0.721	3.502	0.031
TSYS	Net-benefit	0.827	4.107	0.019
Dependent variable; ‘user overall perception’ toward proposed platform; R^2 = 0.816; F= 0.018; Sig= 0.00				

The beta weight indicates that ‘technology-fit’ and ‘net-benefit’ have strong relationships with the dependent variable, with significant levels of 0.031 and 0.019 respectively. The results indicate that those independent variables play a significant role in affecting the dependent variable; furthermore, the direction of this effect is positive.

Table 6-11 also represents the values of the model’s ability to calculate the outcome variable. For this model, the value of R^2, which is a measure of how much of the variability in the dependent variable is accounted for by the independent variables, is 0.816. This value indicates that both independent variables account for almost 81.6% of the variation in the user’s positive perception towards the proposed model. Also worthy of mention is that the value of F is significant (smaller than 0.05), which shows that the independent variables do a good job in explaining the user’s overall perception. It is concluded that all the values confirm the significant positive effects of the proposed model on the overall user perception in relation to the ‘net-benefit’ and technology-fit of the model with their utility management tasks needs (Figure 6-12).

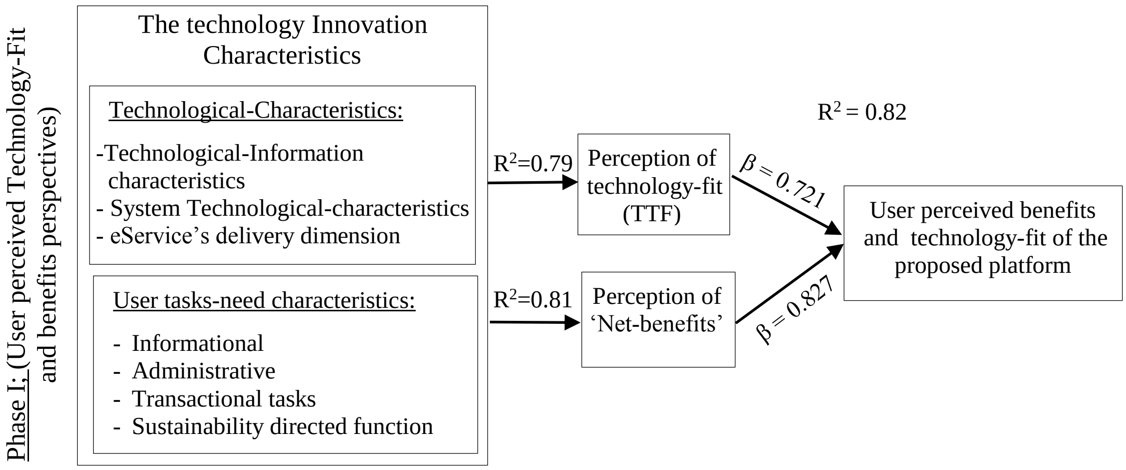

Figure 6-12: Theoretical framework to test user overall perception towards the proposed ‘integrated virtual enterprise utility management’ model

The results obtained in Figure 6-12 indicate that, although the parameter sign obtained was as expected, there were significantly high levels achieved in relation to the independent variables 'technology-fit' and 'net-benefit' with beta values of (0.721, p=0.031 and 0.827, p=0.019 respectively). For this reason, the research sub-hypothesis (H.a (1) and H.a (2)) of phase I in the research model of this study were accepted. On the other hand, both the sign and the explanatory capacity of the parameter relating to independent variables ('technology-fit' and 'net-benefit') with the dependent variable ('user overall perception'), attained satisfactory levels with high R^2 values obtained (R^2 = 0.816), which implies the significance of these variables in positively affecting the overall user perception, thus the main hypothesis H.a is accepted as well (Table 6-12). The findings support the assumption that the proposed technology innovation with more user-centric characteristics will potentially influence users' perception of 'technology-fit' and 'net-benefits', which may lead in turn to a positive user evaluation and indeed their overall satisfaction.

Table 6-12: Test results of the research hypotheses of phase I of this study

Hypotheses		Results
Main H.a:	The creation of an 'integrated virtual enterprise utility management' model, reflected in a 'one-stop' platform, will positively affect users' engagement with utility services, as well as their overall perception, with a focus on 'technology-fit' and 'net-benefits'.	Supported
H.a (1)	Utility users have a positive perception of the 'technology-fit' of the proposed 'integrated virtual enterprise utility management' model in line with their online utility services management needs.	Supported
H.a (2)	Utility users have a positive perception of the potential 'net-benefit' outcomes of creating the proposed 'integrated virtual enterprise utility management' model in line with their online utility services management needs.	Supported

In summary, based upon the above discussion, we realise that technological innovation characteristics and task-technology fit with regards to different user's abilities are important factors affecting a user's perspective towards technology innovation where rational users assist technology innovativeness according to their ability to manage utility tasks effectively. In addition, a user's positive opinion as regards to the initiation of the 'integrated virtual enterprise utility management' model has been identified as most likely to be impacted by a user evaluation of technology-fit as well as net benefits of the initiation of the research model

Chapter 7: User Acceptance Data Analysis and Influence on Individual Sustainable Behaviour

Introduction, measurement dimensions and scale reliability, pre-data analysis results (reliability and validity), data analysis findings of validating of the proposed platform from user perspectives.

7.1 Introduction

The aim of this research was to validate the adoption of an integrated virtual enterprise utility management innovation model. This study also examined the influence of sustainability related functions integrated in the research model to promote users' behavioural intentions towards sustainability. User technology acceptance, innovation adoption theory, specific perceived innovation characteristics measurement instruments, and the theory of planned behaviour (TPB) form the theoretical framework underpinning this research. The theoretical validation research framework was formulated from the user technology innovation adoption model and its influence on promoting individual's sustainability behaviour. It was assumed that user technology acceptance is related to perceived innovation characteristics and that adoption tends to be influenced by the attribute of technology innovation. The influence of sustainability related functionality that was integrated within the model was also included in the validation framework to predict the model's potential effects to promote pro-environmental behaviours.

Two phases of validation of the research model were defined in this research: the user technology acceptance in relation to perceived innovation characteristics, and their evaluation of the model effects on their sustainability behaviour. More specifically, there are six attributes of a users intention to adopt innovation, which are: compatibility with prior-experience, compatibility with values, measurability, communicability, others' use, and trailability. In addition, there are three behavioural related measurements of the evaluation of model potential effects on their behavioural intentions towards sustainability. These six attributes of innovation characteristics and three behavioural related measurements, were included in the study.

As described earlier in Chapter 3, a review of previous literature was conducted in order to specify which theories and variables are related to this research model of technology acceptance and individual behaviour intention. During this literature review, the researcher identified those studies that could help formulate this research's theoretical validation framework in the context of eServices and utility management over the Internet. Those theories and variables which related to the individual innovation technology adoption and sustainable behaviour were selected. More specifically, the TAM, DOI, perceived characteristics of innovation (PCI) and theory of planned behaviour (TPB) were selected as an appropriate theoretical base to be used in the validation phase of this research (as justified earlier in Chapter 3). A diagram of the research model is shown in Figure 7-1.

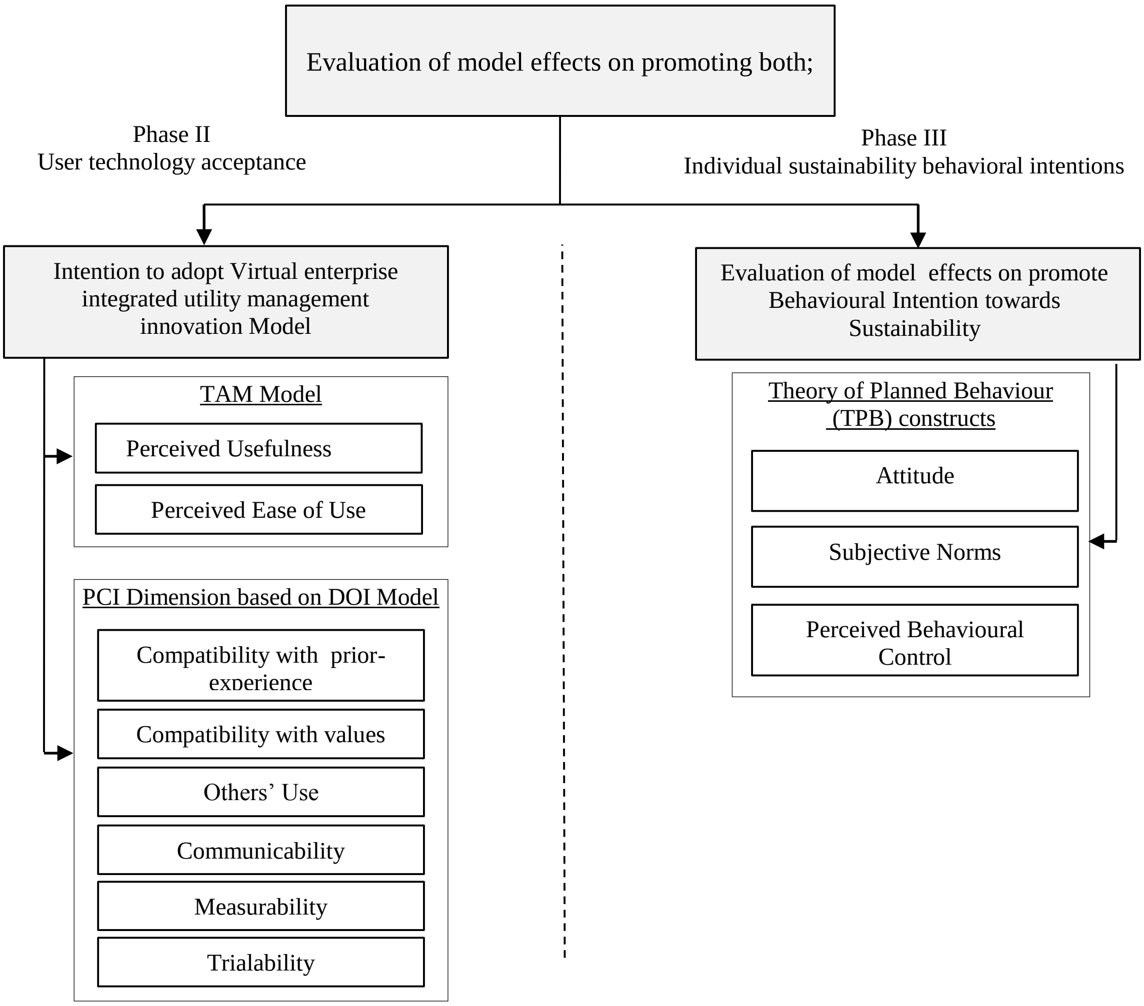

Figure 7-1: Theoretical conceptual framework (Source: Author)

To validate the research model, a questionnaire was developed and implemented among utility user residents of Riyadh city (Saudi Arabia). The analysis consisted of assessing whether each of the model components, comprising the conceptual framework, were related to the users technology adoption of the research model and its effects on their sustainability behavioural intention.

The validation phase was used the theoretical validation framework approach and measurement dimensions of user technology acceptance and behavioural intention to sustainability behaviour as formulated in Chapter 3. This chapter begin by the pre-data analysis results, which are a preliminary stage to prepare the data for advanced statistical analysis (Section 7.2). Sections 7.3 and 7.4, present the results of validating the users' acceptance of the integrated virtual enterprise utility management' platform (or 'one stop' model) and a detailed discussion of findings. This chapter also includes a description of the results that have emerged from the evaluation of the model's effects to promote individual behavioural intention towards sustainability. This chapter concludes with a brief summary of the findings and the results of the hypothesis testing.

7.2 Pre-data analysis results (pre-analysis)

The data collected for this study was analysed using SPSS (i.e. statistical package for social sciences) software to explore both the users' intention to use the innovation of 'integrated virtual enterprise utility management' platform (or 'one-stop' model) and the research model effect on individual behaviour intention to environmental sustainability. The SPSS tools present the results of the distribution of the respondents' demographic characteristics information, which found that the percentage was representative of the populations. Some survey items were reverse coded to be appropriate for the context of this study. For instance, to present the positive effect on users' intentions to accept the innovation and in order to verify response validity, I used the items: PUSF4 perceived usefulness, CMU2 communicability, OU3 others' use, and CMPV1 compatibility of perceived values. The survey items were tested for both reliability and validity. The Cronbach's alpha coefficient for each research construct was tested for reliability, while a factor analysis was used for construct validity (convergent and discriminant) for all survey constructs. Hypotheses were tested using multiple linear regression analysis. The analysis was used to examine capabilities for predicting the users' future intention to use the innovation. The analysis was also used to examine potential effects of sustainability-related functions within the technology innovation model on individual behaviour intention to environmental sustainability. Furthermore, both critical factors of PCI and behavioural intention determinants influence the utility of the users' willingness to accept the innovation and to study the potential effects of the model on individual intention to sustainability, which were identified and ranked according to sorted means of dependent variables. The data analysis is discussed in the following sections.

7.2.1 Reliability and validity

Reliability analysis is important to assess the research survey questionnaire and to verify the internal consistency of the variables (Chu and Murrmann, 2006). The purpose of the reliability analysis is to ensure that the scale used in the questionnaire consistently measures the questionnaire variables and that the items are internally consistent in the survey instrument. In reliability analyses, Cronbach's alpha is the most commonly used measurement in related research. To ensure consistency and reliability, theory-based definitions of the integrated virtual enterprise utility management platform (or 'one-stop' model) and user intention determinants to accept the innovation and effects to promote behavioural intention to sustainability were defined and used for each survey question in the questionnaire. The survey items' internal consistency and reliability were tested by calculating the Cronbach's alpha (Nunnally and Bernstein, 1978). Normally, the Cronbach's alpha coefficient value for assisting reliability falls in the ranges of 0 to 1, where values closer to 1.0 show more internal consistency of the items in the scale. The minimum sufficient Cronbach's alpha value is 0.6, as suggested by Nunnally Jum and Bernstein Ira (1978).

The measures in the first part of this questionnaire were adapted from previous studies. The measures of relative advantage were adapted from Moore and Benbasat (1991), Huang (2006), Horst et al. (2007), and Wangpipatwong et al. (2008), in addition to construct of TAM; perceived usefulness. Other items of compatibility, complexity, communicability, measurability, and others' use were adopted from other studies (Carter and Belanger, 2004a, Vijayasarathy, 2004, Reddick, 2005, Hernandez and Mazzon, 2007, Wang et al., 2005, Ha and Stoel, 2009, Venkatesh et al., 2003, Hsu et al., 2007), while trialability was taken from Moore and Benbasat (1991), Agarwal and Prasad (1997), and Venkatesh et al. (2003). The items used to measure the users' intentions to accept the technology innovation were adapted from Pavlou (2003) and Gefen and Straub (2000). A detailed list of the survey instrument items (part one) of user intention to innovation acceptance is provided in Chapter 3 (Table 3-4). Each item scale was a Likert-type scale ranging from 1 to 5 (1 strongly agree and 5 strongly disagree).

The perceived characteristics of the ‘integrated virtual enterprise utility management’ platform (or ‘one-stop’ model) were measured using a 52-item questionnaire, which comprised: 14 items for the perceived usefulness scale, 11 items for the compatibility scale (8 items for CMPE, 3 items for CMPV), 9 items for the perceived ease-of-use scale, 5 items for the others’ use scale, 4 items for the communicability scale, 4 items for the measurability scale, and 5 items for the trialability scale. The reliability of all of the items was verified using Cronbach’s alpha (Cronbach and Murphy, 1970). Table 7-3 illustrates the reliability analysis results for the study constructs, including the number of items analysed and alpha and standardised values. Based on the literature review and the theoretical foundation of TAM, DOI and six PCI constructs were included, which are: perceived usefulness, perceived ease of use, compatibility with prior experience, and compatibility with values, communicability, measurability, trainability and others’ use.

The second part of this questionnaire surveyed the effect of the sustainability-related functionality within the research model on user behavioural intention to sustainability. The measures were adapted from previous studies where the TPB is a widely applied theoretical framework for explaining behaviour and behaviour change at an individual level, as described earlier in Chapter 3.

This research follows an instruments framework initiated by, for example, Ajzen (1991) in defining the survey measurement constructs based on the TPB. It is used to explore the extent to which sustainability related functionality integrated in the research model can promote the individual behavioural intention to sustainability. Both effects on the three main TPB determents and on the behavioural intention as a dependent determinant were examined in relation to sustainability behavioural intentions. This study was aligned with the recent need for research to focus on behavioural intention at an individual level to improve environmental behaviour (Spence et al., 2009). As shown in chapter 3 (Table 3-5) a detailed list of the survey instrument items that potentially affect the promotion of user behavioural intention to sustainability was identified. Each item scale was a Likert-type scale, ranging from 1 to 5 (1 strongly agree and 5 strongly disagree). The effects of sustainability-related functions within the research model to promote user behavioural intention to sustainability were measured using a 12-item questionnaire, comprised of 4 items for each TPB measure scale. The reliability of all the items was verified using Cronbach’s alpha (Cronbach and Murphy, 1970). Table 7-1 illustrates the reliability analysis results for the study constructs, including the number of items analysed as well as alpha and standardised values. Based on the literature review and the theoretical foundation of TPB theory, the three constructs of TPB included: attitudes, subjective norms and perceived behavioural control.

All of the items in the questionnaire were assigned to both the related perceived innovation characteristic variable and user behavioural intention to sustainability, as measured by TPB constructs. The values of the Cronbach's alpha in Table 7-1 indicate that all of the values fell in the range of 0.803 to 0.971, demonstrating that all of the items used to measure different constructs are internally consistent. Of all the constructs, the variable perceived usefulness was highest at 0.971 while communicability and measurability had the lowest values of 0.803 and 0.829, respectively. The reliability analysis results show acceptable reliabilities for all of the variables used in this study (above 0.80). The statistics on Table 7-1 highlight the evidence that all of the variables are significantly reliable, which supports our assumptions about their reliability.

Table 7-1: Reliability Analysis (Alpha Coefficients for Factors Resulting From Factor Analysis)

Measurement constructs		
Innovation technology acceptance measure (PCI Constructs)	Items	Cronbach's alpha (α)
Perceived Usefulness (PUSF)	14	0.971
Ease-of-use(PEOU)	9	0.938
Compatibility:		
Compatibility with prior experience (CMPE)	8	0.908
Compatibility with values(CMPV)	3	0.881
Others' use (OU)	5*	0.889
Result demonstrability:		
Communicability (CMU)	4	0.803
Measurability (MSA)	4	0.829
Trialability(TRI)	5	0.962
Behavioural intention to sustainability measures (TPB Constructs)	Items	Cronbach's alpha (α)
Effects of sustainability-related functionality on attitudes	5	0.937
Effects of sustainability-related functionality on subjective norms	5	0.968
Effects of sustainability-related functionality on perceived behavioural control	5	0.915
* Originally this construct was measured with six items. One item was dropped to improve reliability.		

7.2.1.1 Content validity

Content validity was verified using a critical evaluation of the definition of each construct included in the survey by reviewing the theories and research findings relevant to the validation framework used in this thesis, including: previous research studying in users' technology acceptance and effects of perceived characteristics of innovation on user intention to use the technology and promote individual behavioural intention to sustainability. In the first part of the validation phase, the item content for each construct was adapted from existing scales in the relevant literature of online services adoption in the similar fields of e-government, e-commerce, and e-banking. The second part of validating the influence of the research model to promote sustainability is adopted from relevant literature of consumption behavioural change and design interventions to promote household saving energy and resource consumptions. The survey constructs and items' content were also validated by other PhD researchers who work in the same area of technology adoption and sustainability behaviour change. Therefore, the measures are believed to have sufficient content validity.

7.2.1.2 Convergent validity

In general, the aim of the validity analysis is to verify that the survey instrument accurately measures what it intends to measure. To analyse the survey construct validity of the first part of this study, the TAM, six PCI constructs and behavioural intention to sustainability measures (TPB Constructs), were evaluated according to their factor loading values using SPSS software. The factor loadings results of all items values are given in Table 7-2. The expected outcome of factor loading analysis is to measure the strength of the items' relationship with its relevant constructs. Items with a high value of loading indicate a significant correlation of the items with the related constructs that they were loaded with. In this study, the factor loadings for all items are illustrated in in Table 7-2. The items' loading values ranged from 0.607 to 0.908, indicating that almost all of the items were loaded very well with their related construct.

Table 7-2: Factor analysis of research variables and detailed variable items of perceived characteristics of the integrated virtual enterprise utility management platform (or 'one-stop' model)

S No.	Items	Description	Factor Loadings	Detailed item definition
		TAM; Perceived usefulness		
1	PUSF0	Time saving	0.876	Using the 'one-stop' utility management enables me to save my time and accomplish tasks more quickly?
2	PUSF1	Convenience	0.892	I get all the information I need for taking care of my utility management transactions more conveniently from 'one-stop' online utility management than from traditional service providers' websites.
3	PUSF2	Communication channel	0.762	By using 'one-stop' online utility management, I get better service than from service providers' websites or branch offices.
4	PUSF3	Quality of services	0.734	Using the 'one-stop shop' utility management will improve the quality of the utility resource management I am looking for.
5	PUSF4	Perceive usefulness	0.876	I find 'one-stop' utility management not useful.
6	PUSF5	Perceive consequences	0.876	I find the use of 'one-stop' utility management to have superior features than existing utility services providers' websites and will have a positive impact on my utility management function.
7	PUSF6	Perceived Value	0.884	Would you value the integration of online utility services in 'one-stop' single windows of interface into the utilities management on the internet?
8	PUSF7	Quality of Information	0.724	The innovation of 'one-stop' online utility management will benefit me to know more about accurate utility resource consumption.
9	PUSF8	Sharing of Information	0.901	The innovation of 'one-stop' online utility management will increase my awareness of my existing energy/utility resource usage.
10	PUSF9	Decision Support services	0.794	It would be useful to have a utility business intelligent agent in the 'one-stop utility management who would manage my utility portfolio and search information for me with regular recommendations according to my profile and utility usage targets that I have defined.
11	PUSF10	Services responsiveness	0.668	Using the 'one-stop' utility management enables me to have responsive and ad-hoc information about service choices and live utilities usage feedback.
12	PUSF11	Functionality Features	0.842	Using the 'one-stop' utility management enables me to achieve my goals of saving costs and resource usage depreciation for environmental reasons.
	PUSF12	User-profile and utility usage target sitting	0.798	I value initiating the function that enables setting the utility usage target within the integrated utilities service management innovation, making it easier for me to control my utility usage.
13	PUSF13	Controllability	0.657	Using the 'one-stop' online utility management gives me greater management tools to control my utility consumptions.
14	PUSF14	Service satisfaction	0.813	Overall, I find using the 'one-stop' online utility management to be advantageous in performing my home utility management tasks.

PCI ; Compatibility with Prior experience (CMPE)				
15	CMPE0	Compatibility with existing online utilities management	0.829	During the last 12 months, I have used the existing online utilities service management website and I feel it is compatible with my skills.
16	CMPE1	Skills experiences	0.772	I am familiar with managing my utilities' services online and they are compatible with my skills experiences.
17	CMPE2	Compatibility with new innovation	0.900	Using the 'one-stop' utility management was a new experience for me.
18	CMPE3	Compatibility with new innovation	0.778	Using 'one-stop' utility management was different from everything that I have experienced before.
19	CMPE4	Compatible of new innovation	0.867	For me, using the innovation of 'one-stop' integrated utilities service management to manage my utilities portfolio will be a positive experience.
20	CMPE5	Compatible of new innovation with prior experience	0.771	'One-stop' online utility management is compatible with my experience with the available utility service provider's website.
21	CMPE6	Compatible with knowledge and skills	0.810	I have the necessary knowledge and skills to use the integrated 'one-stop' utility management on the internet.
22	CMPE7	Overall experience compatibility	0.719	Please rate your overall level of your experience compatibility with the innovation of integrated 'one-stop' utilities management.
PCI ; Compatibility with Values (CMPV)				
23	CMPV0	Compatibility with values regards utility resources management	0.833	Using integrated 'one-stop' utility management provides capabilities or potentials that are in line with my values or beliefs about efficient management of my utility resources and control resource usage.
24	CMPV1	Innovation Compatibility with values	0.661	The integrated 'one-stop' utility management provides capabilities that conflict with my values.
25	CMPV2	Overall Innovation Compatibility with values	0.831	Using the integrated 'one-stop' utility management is completely consistent with my values.
TAM ; Perceived Ease-of-use (PEOU)				
26	PEOU0	Accessibility	0.897	I am interested in having an integrated 'one-stop' utilities management innovation with one-click administration of all my utilities accounts.
27	PEOU1	Functionality ease-of-use	0.764	Using the integrated 'one-stop' utility management innovation makes it easier to do my utility management tasks.
28	PEOU2	Interface attractively and effortless	0.614	I would find integrated 'one-stop' utilities management innovation to be easy to interact with and require the least effort needed to manage my utilities.
29	PEOU3	Familiarity	0.831	I find it easy to learn how to use the integrated 'one-stop' utility management innovation.
30	PEOU4	Integrated services provision	0.697	In the case of grouping online utility services in one place, does that make you better use and adopt these services?
31	PEOU5	Personalized online services provision	0.745	Using a personalized online services provision will contribute to making the online utility management easy and friendly to use.

32	PEOU6	Payment transactions	0.840	Using a single point of utility bills payment in 'one-one stop' utility management would be easier for me to conduct transactions and enable me to pay more quickly.
33	PEOU7	Information sharing and communication	0.678	I believe the integration of all utility services online in 'one-stop' utility communication environment will enable the ease of interaction with all utilities parties (service providers, services regulator, sustainable community, etc.)
34	PEOU8	Overall ease-of-use	0.897	Overall, I believe that the one-stop utility management is easy to use.
PCI ; Others' use (OU)				
35	OU0	Influence of others' use	0.607	For changing my intention to use the innovation, I am influenced by my peers' decision to use the innovation.
36	OU1	Awareness of others' use	0.780	In my area, people are aware of managing utility services online.
37	OU2	Influence of Others' use	0.908	Some of my friends in this city are using the online services on the Internet to manage their utility services.
38	OU3	Influence of Others' use	0.754	I have not seen many others using the Internet to do the utility management functions.
39	OU4	Influence of service provider or regulator	0.875	For changing my intention to use the innovation, I am influenced by utilities service provider/regulator advice or recommendations.
PCI ; Communicability (CMU)				
40	CMU0	Co-operative communication medium	0.825	I believe that 'one-stop' utility management will be an appropriate communication medium for interaction with utility service providers and other utility parties to archive better utility resource savings.
41	CMU1	Share depreciation benefit	0.904	Using 'one-stop' utility management is advantageous for me, and I am willing to use the innovation as a communication medium to share resource usage depreciation benefits with other third parties that are providing service integration and advice.
42	CMU2	Communicability with others	0.681	The potential communication to other utility parties using 'one-stop' utility management innovation would be difficult.
43	CMU3	Communicability with communities	0.839	It is one of my demands to have an interaction medium to communicate with sustainable communities online to participate in saving environment resources.
PCI ; Measurability (MSA)				
44	MSA0	Measurement of potential outcomes	0.873	It is easy for me to realize the outcomes benefit of using the 'one-stop' utility management innovation.
45	MSA1	Level of Measurement complexity	0.840	The results of using 'one-stop' utility management innovation are easy to measure.
46	MSA3	Results visibility	0.654	The results of using 'one-stop' utility management innovation are obvious.
47	MSA5	Capability of measure potential advantages	0.714	The advantages of using 'one-stop' utility management innovation are easy to measure and evaluate.

PCI ; Trialability (TRI)				
48	TRI0	General trialability willingness	0.786	I am willing to try using it.
49	TRI1	Functionality trialability willingness	0.753	I am likely willing to try out a various 'one-stop' utility management functionality to manage my utility services.
50	TRI2	Trialability willingness with other parties	0.736	I have the willingness to try the innovation to participate with other utilities' stakeholders to archive more efficient use of utility resources.
51	TRI3	Trialability opportunities	0.845	I have had many opportunities to try out the 'one-stop' utility management innovation
52	TRI4	Overall trialability interest level	0.792	Please rate your overall level of interest in trying it.
Sustainability-related functionality on behavioural intention to sustainability; Effects on (TPB; Attitudes towards the behaviour (ATT))				
53	ATT0	Beneficial	0.854	For me, using innovation and sustainability-related functionality for utility resource management of my utilities portfolio will present a high potential for gain.
54	ATT1	Positive experience – wise – not wise idea	0.837	I would think using the sustainability-related functionality (goal setting, real-time feedback demonstration, etc.) will be a positive experience and wise to be applied?
56	ATT2	Favourable – unfavourable	0.915	My attitude towards using the innovation for sustainability purposes would be favourable.
57	ATT3	Over all attitudes; good idea –bad idea	0.837	Overall, I would support the idea of integrating virtual enterprise integrated utility management framework; so I think it is a good idea
Sustainability-related functionality on behavioural intention to sustainability; Effects on (TPB ; Subjective norms (SBN))				
58	SBN0	Decision influenced by comparison with other neighbourhood consumption	0.950	My decision to sustainable behaviour would be influenced by the features of sustainability reeled behaviour in the research model; specifically by: neighbourhood comparison of utilities resource use behaviour.
59	SBN1	Decision influence by comparison with regional consumption	0.756	My decision to sustainable behaviour would be influenced by; regional comparison and they have great impact on my behaviour.
60	SBN2	Decision influence by service provider or services regulator comparison data	0.814	My decision to sustainable behaviour would be influenced by; comparison provided by utilities service provider or services regulator with advices and recommendation
61	SBN3	Overall rate of influence of my decision by other	0.789	If I know that other using the innovation for better sustainable behaviour, I will be more influenced to do same.
Sustainability-related functionality on behavioural intention to sustainability; Effects on (TPB ; Perceived behavioural control (PBC))				
63	PBC0	Control belief	0.851	Using the innovation and sustainability-related functionality makes me feel that sustainability behaviour was entirely within my control
64	PBC1	Facilitating conditions	0.767	Using the innovation and sustainability-related functionality help in facilitating my future intention to sustainable behaviour
65	PBC2	knowledge/self-efficacy	0.873	It will positively affect my knowledge, and the ability the towards pro-environmental behaviour
66	PBC3	Past experience	0.784	Using the innovation and sustainability-related functionality will promote my experience to deal sustainability behaviour

In the literature on technology innovation adoption, Moore and Benbasat (1991) developed a precise and reliable instrument to measure the perceptions of adopting information technology innovation using the diffusion of innovation constructs (Rogers Everett, 1995). This instrument consists of eight measurement constructs of the perceived characteristics of technology innovation. Some related studies considered that both perceived relative advantage and compatibility are similar and loaded in a single construct (Karahanna et al., 1999, Moore and Benbasat, 1991). In fact, while the two constructs were defined as different constructs, some scholars conducted their studies by loading these constructs together. According to Moore and Benbasat (1991), while the constructs are 'conceptually different, they are viewed identically by respondents, or there is a causal relationship between the two'. It is 'unlikely that respondents would perceive the various advantages of using [online services], if its use were in fact not compatible with the respondents' experience or work style' (Moore and Benbasat, 1991, p .208). In this study of testing technology acceptance (validation phase I), the researchers tested the two constructs that were originally defined by the theories to predict the utility users intention to use the new innovation of integrated virtual enterprise utility management platform (or 'one-stop' model). This testing also gave the researchers a better insight into how to explore the users' perceptions.

Furthermore, in the second part of the validation phase, this study follows best practice guidelines of Ajzen (1991) in designing a reliable instrument to measure the model effects to promote individual behavioural intention based on the TPB. This study also explores the extent to which behaviour related constructs of TPB are affected by sustainability-related functionality integrated within the research model, and the extent to which it can promote the overall individual behavioural intentions towards sustainability. This supports a recent need to promote sustainability by emphasising environmental behaviour on an individual level (Spence et al., 2009).

7.2.1.3 Discriminant validity

Discriminant validity is used to show that the measure of interest is not inappropriately related to a measure of a completely distinct construct (Messsick, 1995). The items load result should more highly correlate with other items of the same construct rather than with other items of other constructs. Fornell et al. (1982) suggested that the squared correlations between two different measurement constructs must be lower than the variance shared by the measures of a construct. By adopting this suggestion, the researchers tested the discriminant validity of the survey instruments' items and related constructs, the results are presented in Table 7-3. All of the shared variances between any two constructs were smaller than the amount of variances extracted by one of the two constructs. Therefore, the constructs of the survey for this study had sufficient discriminant validity. Consequently, it could be considered valid for further analysis in predicting future user intention to use the innovation of the integrated virtual enterprise utility management platform (or 'one-stop' model) (Table 7-2) and to investigate model potential effects to promote individual behavioural intention to sustainability (Table 7-3).

Table 7-3: Pearson correlation coefficients and discriminant validity test (diagonal elements are a square root of the AVE)

Constructs	Perceived innovation characteristics measurement (PCI constructs)								Behavioural intention towards sustainability (TPB constructs)		
	PUSF	CMPE	CMPV	PEOU	OU	CMU	MSA	TRI	ATT	SBN	PBC
PUSF	0.809										
CMPE	0.042	0.734									
CMPV	0.011	0.072	0.812								
PEOU	0.013	0.060	0.012	0.680							
OU	0.199	0.031	0.003	0.022	0.591						
CMU	0.038	0.061	0.072	0.038	0.091	0.733					
MSA	0.106	0.012	0.013	0.061	0.109	0.023	0.821				
TRI	0.039	0.017	0.053	0.046	0.072	0.018	0.062	0.664			
ATT	0.111	0.045	0.153	0.065	0.189	0.045	0.076	0.015	0.887		
SBN	0.056	0.307	0.037	0.110	0.020	0.117	0.178	0.021	0.146	0.912	
PBC	0.052	0.050	0.146	0.095	0.328	0.209	0.326	0.123	0.341	0.062	0.850

Diagonal elements represent the average variance extracted, while the other matrix elements represent the shared variance.
The correlations between any two distinct RA, CMPE, CMPV, PEOU, OU, CMU, MSA, TRI were lesser than 1.0 and AVE for diagonal elements are above cut-off value of 0.5 as recommended by Fornell and Larcker (1981).

When conducting the regression analysis, the possibility of the multicollinearity problem was also checked. The Pearson correlation matrix for constructs of TAM, DOI, the PCI and the integrated virtual enterprise utility management platform (or 'one-stop' model) effect on individual behavioural intention (i.e., TPB constructs) was examined for the extent of multicollinearity problems (see Table 7-3 and Table 7-4). Multicollinearity exists when the overall p-value might be significant, but the p-value for each predictor might not be significant and the correlation between the coefficients is very high (i.e., above 0.9). In this study, none of the correlation values (see Table 7-3 and Table 7-4) were above 0.90. The highest squared correlation among the independent variables was 0.19, which was between the measure of perceived usefulness and complexity of innovative model of this study. None of the squared correlations were close enough to 0.80 to suggest a problem with multicollinearity among the research variables (Hair Jr et al., 1995). Second, the p-value for each predictor is also significant. Moreover, the values of tolerance (above 0.2) and variance inflation factor (VIF) (below 5) for each predictor confirmed that there was no evidence of significant multicollinearity among the research variables.

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Table 7-4: The Variance Inflation Factor (VIF) and correlation Matrix for PCI dimension of the integrated virtual enterprise utility management platform (or 'one-stop' model)

Constructs	No. Items	Collinearity Statistics		IU	PUSF	CMPE	CMPV	PEOU	OU	CMU	MSA	TRI
		Tolerance	VIF									
IU	1	0.735	1.361	1.000								
PUSF	14	0.651	1.536	0.074	1.000							
CMPE	8	0.854	1.171	0.062	0.013	1.000						
CMPV	3	0.751	1.332	0.023	0.018	0.457**	1.000					
PEOU	9	0.594	1.684	0.037	0.191	0.054	0.065	1.000				
OU	5	0.624	1.603	0.154	0.121	0.134	0.125	0.254*	1.000			
CMU	4	0.934	1.071	0.128	0.244**	0.264**	0.465**	0.015	0.125	1.000		
MSA	4	0.585	1.709	0.018	0.065	0.397*	0.019	0.054**	0.354**	0.036	1.000	
TRI	5	0.854	1.171	0.043	0.124	0.185*	0.065*	0.048	0.075	0.064*	0.467**	1.000

- IU : User intention to accept the 'one-stop' utility management innovation
- * $p < 0.05$; ** $p < 0.01$.
- Values of tolerance for all predictors are > 0.2
- Values of variance inflation factor for all predictors (VIF) are < 5

Table 7-5: The Variance Inflation Factor (VIF) and correlation Matrix for behavioural intention dimension of research model effects on individual behaviour intention to sustainability

Constructs	No. Items	Collinearity Statistics		BI	ATT	SBN	PBC
		Tolerance	VIF				
BI	1	0.834	1.199	1.000	.		
ATT	4	0.788	1.269	0.061	1.000		
SBN	4	0.754	1.326	0.079	0.002	1.000	
PBC	4	0.698	1.433	0.038	0.034	0.317**	1.000

- IB : Effects of sustainability-related function (within research model) on user behavioural intention towards environmental sustainability
- * $p < 0.05$; ** $p < 0.01$.
- Values of tolerance for all predictors are > 0.2
- Values of variance inflation factor for all predictors (VIF) are < 5

7.3 Data analysis results of validating the user acceptance of an integrated virtual enterprise utility management platform

7.3.1 Correlation matrices

Correlation is a statistical method that is used for measuring or describing the relationship between two variables. Although identifying the correlations among variables is essential, it cannot be described as a relationship between cause and effect. The information given can only be taken as an indicator. Correlation analysis can be applied either independently or as a preliminary stage to regression analysis. Correlation analysis can demonstrate which variables have closer relationships with the independent variable and should be included in the model. Correlations among the eight PCI constructs, in the context of the user's perception towards the acceptance of the integrated virtual enterprise utility management platform (or 'one-stop' model), are presented in Table 7-6.

An initial correlation analysis was conducted to analyse the relationship between the users' perception to different characteristics of the integrated virtual enterprise utility management platform (or 'one-stop' model) and their intention to accept and adopt these services. Table 7-6 shows the correlation of intention to use the model and perceived innovation characteristics. The eight innovation characteristics (independent variable, RA, PEOU, CMPV, CMU, TRI, CMPE, and MSA) were positively correlated with the construct of users' perception to use of the integrated virtual enterprise utility management platform (or 'one-stop' model), and all were statistically significant. In addition, others' use (OU) was partially correlated with the dependent construct of users' perception of using the innovation and was also partially statistically significant. These correlations were all expected, excluding the OU variable, which provides support for the identified hypotheses.

Table 7-6: Correlation matrix for 'intention to use' the integrated virtual enterprise utility management model and perceived characteristics determinants

Constructs	Perceived Characteristics Determinants							
	PUSF	CMPE	CMPV	PEOU	OU	CMU	MSA	TRI
Pearson Correlation	0.164**	0.354**	0.451**	0.279**	0.213**	0.415*	0.201*	0.429**
Sig. (2-tailed)	0.001	0.000	0.003	0.001	0.007	0.002	0.003	0.006
N	1178	1178	1178	1178	1178	1178	1178	1178

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

In order to evaluate the theoretical relationships among the relevant factors, a regression analysis was conducted. All of the independent variables were expected to be positively associated with their dependent variables. A detailed data analysis for predicting user intention to use the innovation is illustrated in the next section.

7.3.2 Multiple regression analysis

The data was analysed using multiple linear regression analysis. The purpose of a regression analysis is to relate a dependent variable to a set of independent variables (Mendenhal and Sincich, 1993). Regression analysis was seen as the most appropriate analytical technique since the goal of this study was to determine the relationship between users' intention (dependent variable) and users' perceptions of the integrated virtual enterprise utility management model (independent variables). Assumptions of multivariate normal distribution, independence of errors, and equality of variance were first tested. There were no violations of these assumptions. Multicollinearity was not a concern with this data set, as confirmed earlier by the lack of evidence of significant multicollinearity among the research variables. Outlier influential observations were identified with leverage and standardized residuals, as well as Cook's D-statistic. This analysis indicated that there were no problems with respect to influential outliers. To examine the joint impact, a regression analysis was conducted to predict the users' intentions to use the innovation model and investigate which perceived characteristics of innovation best predicted the users' acceptance. Taking a 5% significance level (2-tailed), the results indicate that the seven characteristics of innovation constructs considered in the model account for 78% for the dependent variable of user intentions to use the innovation model by utility users (see Table 7-7). RA, PEOU, CMPV, CMU, TRI, CMPE, and MSA were statistically significant.

Table 7-7 shows the beta values, indicating the individual contributions of each independent variable to the model. The independent variables RA, PEOU, and CMPV have beta values of 0.441, 0499, and 0.307, which indicates that a change of one standard deviation in any variable will result in a change of 0.441, 0.499, and 0.307, respectively, on standard deviations of the dependent variable users' intention to use the innovation. Similarly, the beta values of the variables CMU, TRI, CMPE, and MSA are 0.057, 0.292, 0.231, and 0.173, indicate that one standard deviation change in perceived navigability will result in a change of 0.057, 0.292, 0.231, and 0.173, respectively. The beta weight indicated that PUSF, PEOU, and CMPV were the strongest predictors, with a level of significance of 0.039, indicating that these independent variables play a significant role in predicting the dependent variable; however, the direction of this effect is positive. This is followed by CMU, TRI, CMPE, and MSA. In addition, the smallest beta weight was found for OU. Evidently, OU, such as users' intentions to try the innovation, influence of others using the services, self-efficacy, and ability to use new innovations, had little to do with users' intention to use the integrated virtual enterprise utility management model of this study. The beta values of all of the variables (excluding others' use OU) are positive, showing their significant positive individual contribution in bringing change to the dependent variable. The t-statistic along with the beta value is a measure of the probability that the actual value of the beta is not zero. The larger the absolute value of t, the less likely that the actual value of the beta could be zero.

Table 7-7: Regression coefficients on predicting users' acceptance of the integrated virtual enterprise utility management platform (or 'one-stop' model)

Hypothesis No.	Independent Variables	β coefficient	t-statistic	P-value
H.b (1)	PUSF	0.441	4.430	0.003
H.b (2)	PEOU	0.499	4.132	0.020
H.b (3)	CMPE	0.231	3.168	0.019
H.b (4)	CMPV	0.307	3.614	0.011
H.b (5)	OU	0.057	0.781	0.217
H.b (6)	CMU	0.128	2.910	0.009
H.b (7)	MSA	0.173	2.497	0.034
H.b (8)	TRI	0.192	3.784	0.007
Dependent Variable Adoption of 'one-stop'; $R = 0.973$; $R^2 = 0.947$; $F = 0.021$; Sig. = 0.000				

Table 7-7 also represents the values of the model's ability to calculate the outcome variable (the F test), value of R, the corresponding R^2 and the adjusted R^2. The value of the software is the value of the multiple correlation coefficients between the independent and the dependent variables. For this model, the value of R in which all independent variables are included is 0.973. This value of R provides a measure of how well intention can be predicted from the set of scores of the independent variables. The positive value of R confirms that seven of the eight independent variables in the research model can best predict the users' intention to use the integrated virtual enterprise utility management platform (or 'one-stop' model). The value of R^2, which is a measure of how much of the variability in the dependent variable is accounted for by the independent variables, is

0.947. This value indicates that the seven independent variables account for almost 94.7% of the variations in the users' perception to use the innovation. The value of F is significant (smaller than 0.05), which shows that the independent variables evidently explain the variation in the users' perception to use the new innovation. To conclude, all of the values confirm the significantly good fit of the model.

7.3.3 Hypothesis testing and discussion

Having confirmed the structure of the various scales in terms of reliability, dimensionality and validity, the researchers went on to test the hypotheses proposed in this research to explore the utility users' intention to accept the innovation. In summary, model and hypothesis testing was conducted with eight independent variables 'perceived usefulness' (PUSF), 'ease-of-use' (PEOU), 'compatibility with values' (CMPV), 'communicability' (CMU), 'trialability' (TRI), 'compatibility with prior experience' (CMPE), 'measurability' (MSA), and 'other use' (OU) and one dependent variable (user intention to use the innovation). The basic definitions of perceived innovation characteristics constructs were presented earlier in Chapter 3 (Table 3-4).

The first hypothesis H.b (1) referred to the relationship between users' perceived usefulness (PUSF) of innovation characteristics and intention for acceptance of the integrated virtual enterprise utility management model. It was formulated in Chapter 3, as follow:

> H.b (1): The user's 'perceived usefulness' (PUSF) of the proposed innovation will positively affect their intention towards acceptance and adoption.

The analysis results obtained (see Figure 7-2) indicate that, although the parameter sign obtained was as expected, there were significantly high levels achieved ($p = 0.003$). For this reason, Hypothesis H.b (1) was accepted. On the other hand, both the sign and the explanatory capacity of the parameter relating to perceived usefulness with the dependent variable (intention to accept), attained satisfactory levels. Finally, it must be noted that the high R^2 values obtained ($R^2 = 0.947$) suited the model. The second hypothesis was:

> H.b (2): The user's 'perceived ease of use' (PEOU) of the proposed innovation will positively affect their intention towards acceptance and adoption.

According to the statistical results, the user's PEOU of the integrated virtual enterprise utility management model significantly affects their intention to accept and use the innovation. The beta value 0.499 shows that a one-unit increase in the user's PEOU can result in a 0.499-unit increase in the user's perceptions. This suggests that, if the innovation model is easy to use and not facing difficulty in their functions, then the users will perceive it to be of superior value and they will be more likely to accept it. Thus, H.b (2) is accepted. The third and fourth hypothesis were:

> H.b (3 and 4): The user's perception of the innovation's 'compatibility with [their] prior experience' (CMPE)/ values (CMPV) will positively affect their intention towards acceptance and adoption.

As analysed in the empirical results, the beta values of the compatibility of the two variables are positive (0.307, 0.231), showing that a one-unit increase in compatibility with user's values (CMPV) will cause a 0.307-unit increase in positive perception to the innovation. Similarly, a one-unit increase in compatibility with prior experience (CMPE) will cause a 0.231-unit increase in positive perception of its users. This suggests that well-designed compatibility features of an integrated virtual enterprise utility management model strongly affects the positive perceptions of its users. Thus, H.b (3 and 4) are accepted. The fifth hypothesis was:

> H.b (5): The 'other use' (OU) experience with technology innovation will positively affect their intention towards acceptance and adoption of the innovation.

The statistical results show that the influence of OU or perception of the innovation feature of the integrated virtual enterprise utility management model on the user's intention to accept the innovation has a negative beta value of 0.057. This indicates that it is not a significant predictor of users' perceptions about their intention to accept the innovation. Thus, H.b (5) is not supported. The sixth hypothesis was:

> H.b (6): The user's perception of the innovation's 'communicability' (CMU) will positively affect their intention towards the acceptance and adoption of the innovation.

Innovation communicability is generally understood in terms of the ability on the part of technology to provide an appropriate responsive environment for users to communicate with, in an efficient manner. The results found that innovation's communicability (CMU) of the innovation model creates a positive perception among users about the intention to use the innovation. By having a positive beta value for the variable communicability, it is confirmed that a one-unit increase in the variable communicability will result in a 0.128 unit increase in the perception of users about innovation acceptance. Thus, H.b (6) is supported. In the online utility management context, it is desirable to initiate an environment that makes communication friendly and available for all interacting parties in utility services. Innovation communicability in the utility context can be measured in terms of the ability to communicate efficiently and effectively.

> H.b (7): The user's perception as regards to the innovation's 'measurability' (MSA) will positively affect their intention towards acceptance and adoption of the innovation.

Hypothesis H.b (7) is also supported with positive beta value of 0.173, which shows that, if users perceive the ability to measure the value of the innovation, then they are more likely to have a positive perception about the intention to use the innovation.

> H.b (8): The more "trialable" (TRI) the innovation is from the user and service perspectives, the more positive the effect on their intention towards acceptance and adoption of the innovation.

According to the statistical analysis, the variable trialability (TRI) significantly affects perceptions of users about the intention to accept/use the innovation. The positive beta value shows that a one-unit increase in TRI will increase the users' perception about intention for the innovation acceptance by 0.192 units. Thus, H.b (8) is supported.

As conclude from data analysis findings, most of the hypotheses exceeded their significant acceptance levels, suggesting that the research on the users' innovation prediction model provided positive results in describing the users' willingness to accept the new innovation model in utility. The only exception was the OU construct, whose value was slightly less than 0.06. The results are shown in Figure 7-2 (the research model and path-relationship among variables). Seven of the hypothesized eight paths are significant at the 0.01 or 0.05 level. Figure 7-2 displays all of the relationships among the studied constructs. It indicates that there was a 94.7% variance in users' perceptions of the intention to accept the integrated virtual enterprise utility management platform (or 'one-stop' model). Variance in users' perceptions towards innovation acceptance was 94.7%, entirely explained by PUSF, PEOU, CMPV, CMU, TRI, CMPE, and MSA. PUSF, PEOU, and CMPV/CMPE explain 67% of the variance in the intention to accept the innovation. CMU, TRI, and MSA explain 13%, 11%, and 9% of the variance in users' intention, respectively.

Comparing the relative effects of each determinant on the dependent variables, the users' intention to accept the innovation was separately explained by perceived usefulness (26%), ease of use (19%), communicability (13%), and trialability (11%). In addition, regarding users' acceptance of the innovation, 22% was explained by compatibility, 13% by compatibility with prior experience, and 9% by compatibility with values. Another 9% was explained by measurability. Table 7-8 indicates that seven of the eight sub-hypotheses were significantly supported, only H.b (5) was not empirically supported by the data. The results indicate that OU of innovation did not significantly affect the users' perception towards the innovation model. In summary, perceived usefulness (PUSF), ease of use (PEOU), compatibility with values (CMPV), compatibility with prior experience (CMPE), communicability (CMU), trialability (TRI), and measurability (MSA) are the main determinants of predicting users intention to accept the integrated virtual enterprise utility management platform (or 'one-stop' model). The sub-hypothesised relationship results and their values being tested are illustrated in Figures 7-2 and Table 7-8.

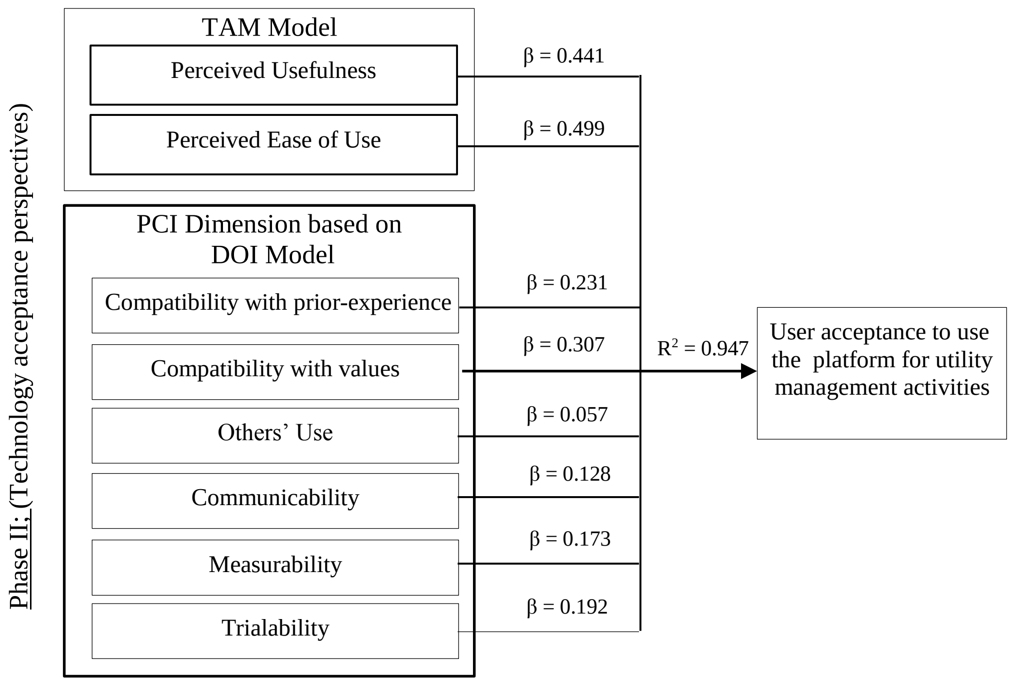

Figure 7-2: Predicted model for user intention to adopt 'the integrated virtual enterprise utility management platform (or one-stop' service model)

Table 7-8: Results of the study hypotheses tested

Hypotheses		Results
Main H.b	The user overall perceptions towards the new innovation characteristics will positively affect their intention to accept and adopt the innovation.	Supported
H.b (1)	The user's 'perceived usefulness' (PUSF) of the proposed innovation will positively affect their intention towards acceptance and adoption.	Supported
H.b (2)	The user's 'perceived ease of use' (PEOU) of the proposed innovation will positively affect their intention towards acceptance and adoption.	Supported
H.b (3)	The user's perception of the innovation's 'compatibility with [their] prior experience' (CMPE) will positively affect their intention towards acceptance and adoption.	Supported
H.b (4)	The user's perception of the innovation's 'compatibility with [their] values' (CMPV) will positively affect their intention towards acceptance and adoption.	Supported
H.b (5)	The 'other use' (OU) experience with technology innovation will positively affect their intention towards acceptance and adoption of the innovation.	Not supported
H.b (6)	The user's perception of the innovation's 'communicability' (CMU) will positively affect their intention towards the acceptance and adoption of the innovation.	Supported
H.b (7)	The user's perception as regards to the innovation's 'measurability' (MSA) will positively affect their intention towards acceptance and adoption of the innovation.	Supported
H.b (8)	The more "trialable" (TRI) the innovation is from the user and service perspectives, the more positive the effect on their intention towards acceptance and adoption of the innovation.	Supported

Table 7-9: Mean rank of the innovation model, PCI influencing customers' perception of online service adoption

Measurement Constructs	Sorted Means
Ease-of-use(PEOU)	4.81
Perceived usefulness (PUSF)	4.72
Compatibility with values(CMPV)	4.51
Compatibility with prior experience (CMPE)	4.44
Communicability (CMU)	4.19
Measurability (MSA)	4.01
Trialability(TRI)	3.97
Others' use (OU)	2.06

Brief summary and discussion

This study proposed and tested the innovation acceptance model in the context of online utility management services. Since the purpose of this research was to investigate users' willingness to use the innovation of integrated virtual enterprise utility management model, a previous theory of online service adoption was employed to predict users' intention to use the innovation. This differs in some aspects from past research, which explored users' technology acceptance focusing mainly on technology acceptance in general (Pavlou and Fygenson, 2006, Hung et al., 2006, Taylor and Todd, 1995b). This study is pioneering with respect to predicting innovation acceptance to the newly emerging context of an online service delivery paradigm in utility services. The results of this study differ from those of previous studies because of the intelligent online service delivery approach embedded in the design of the integrated virtual enterprise utility management platform (or 'one-stop' model). It was mainly created to be a values-driven framework by providing public service values to the users and for all utility stockholders. The significant effects of both perceived usefulness (PUSF) and perceived ease of use (PEOU) on intention to accept the innovation were observed.

Previous studies have found perceived usefulness (PUSF) to have a stronger influence than perceived ease of use (PEOU) (Taylor and Todd, 1995b, Hung et al., 2006, Bhattacherjee, 2000) and this study found a similar level of influence. Hence, in the case of this innovation of integrated virtual enterprise utility management model, both perceived usefulness and perceived ease of use can have a similar level of influence on predicting their intention to accept the innovation. The results of this study clearly support the notion that the greater benefits of online service values for users can significantly affect attitudes towards intention to accept the innovation. This finding is consistent with previous studies in technology acceptance research (Goodhue and Thompson, 1995, Igbaria et al., 1997, Agarwal and Prasad, 1999). In addition, this finding is in line with previous studies, which found that perceived usefulness and ease of use are important factors for implementing public online services (Venkatesh et al., 2003). This study has also indicated the significance of the effects of compatibility with values (CMPV) and compatibility with prior experience (CMPE) on intention to accept the innovation. Previous research testing the impact of compatibility on intention has supported this study's results (Hung et al., 2006), and found that compatibility has a significant effect on attitude in the context of online services (for example in e-government services). Hence, the compatibility finding led to the conclusion that, in terms of online utility management innovation fitting users' existing values, previous experiences and current needs are necessary conditions to consider.

In addition, the effect of innovation communicability (CMU) on intention to accept the innovation is significant. Compared with results in the context of user acceptance of online services in e-business services (Hernandez and Mazzon, 2007), user acceptance of the of integrated virtual enterprise utility management model is significantly attributable to users' perceived innovation communicability. One possible explanation is that potential users expect a higher level of ability to use innovation communicability with service providers and other utility stakeholders before pursuing innovation acceptance.

Consistent with our hypothesis, innovation with higher levels of TRI demonstrated significantly positive perceptions towards the of integrated virtual enterprise utility management model acceptance. These findings support prior research that found a significant direct relationship between TRI and innovation acceptance (Hsu et al., 2007). Therefore, this study further validates the importance of that factor in understanding users' acceptance of the integrated virtual enterprise utility management model. Also consistent with our hypothesis was the finding that innovation with higher levels of measurability (MSA) demonstrated significantly positive user perception intention towards the acceptance of the integrated virtual enterprise utility management model. These findings support prior research regarding the significant direct relationship between innovation measurability and innovation acceptance (Hernandez and Mazzon, 2007). The most interesting finding suggests that OU does not have any significant effect on users' perceptions of using the innovation. This finding contrasts with user acceptance in the context of the influence of others' use, on users' intentions, to accept the innovation in similar online service acceptance studies (Venkatesh et al., 2003, Hsu et al., 2007). One possible explanation for this feature is that utility users have accumulated experiences with similar online services and identified the advantages of such services provided by e-commerce, e-government, e-shopping, e-health, etc. This could lead to reducing the importance of OU as a variable in our study, as well as in the area of investigating users' acceptance of new technology innovation in the utility context.

7.4 Data analysis results of the model's effects on promoting individual behavioural intention to sustainability behaviour

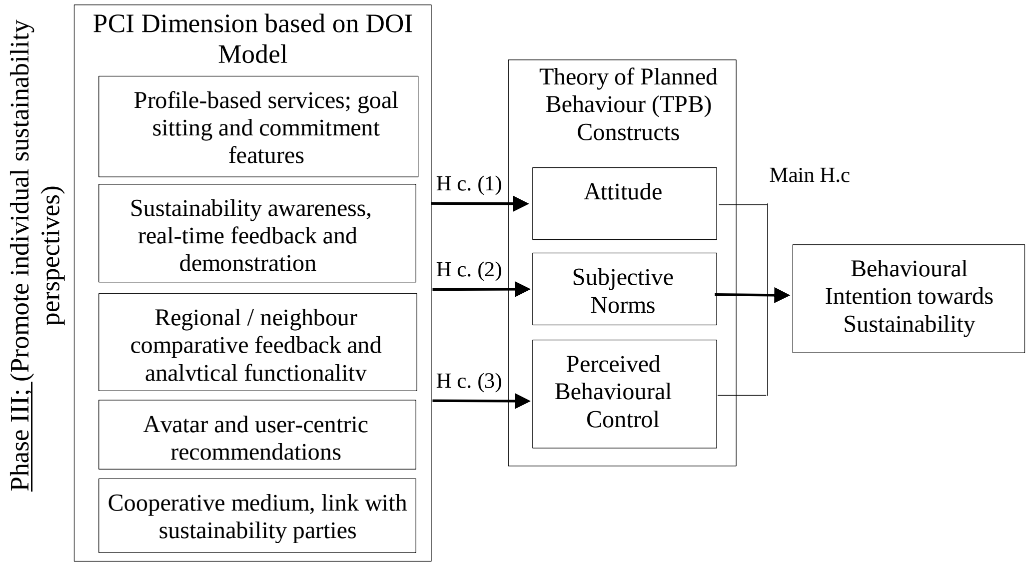

Figure 7-3: Predicted model of effects of sustainability-related functionality integrated in research model on promote user intention behavioural to sustainability

7.4.1 Correlation matrices

As discussed earlier in section 7.3.1, correlation is a statistical method used for measuring or describing the relationship between two variables. Correlation analysis can demonstrate which variables have closer relationships with the independent variable and should be included in the model. Correlations among the three TPB constructs (behavioural beliefs, normative beliefs, and behavioural control beliefs) and the independent variable of individual behavioural intention to sustainability, in the context of examining the relationship of the sustainability-related functions potential effects on promoting users' behavioural intention towards sustainability, are presented in Table 7-10. An initial correlation analysis goal was conducted to analyse the relationship between the sustainability-related functions within the research model and its potential effects on promoting users' behavioural intention to sustainability. Table 7-10 shows the correlation results of behaviour dimension of sustainability-related functions and users' behavioural intention to sustainability. The three behaviour intention determinants (independent variable, Behavioural beliefs (ATT), normative beliefs (SBN), and behavioural control beliefs (PBC)) were positively correlated with the dependent construct of users' behavioural intention to sustainability, and all were statistically significant. These correlations are all in the expected directions, and they provide support for the identified hypotheses.

Table 7-10: Correlation matrix for relationship of sustainability-related functions effects on individual behavioural intention to sustainability using TPB measurements

Constructs	ATT	SBN	PBC
Pearson Correlation	0.808**	0.679**	0.712*
Sig. (2-tailed)	0.001	0.002	0.001
N	1178	1178	1178
** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).			

In order to evaluate the theoretical relationships among the relevant factors, a regression analysis was conducted. All of the independent variables were expected to be positively associated with their dependent variables. A detailed data analysis for predicting the effects on individual behavioural intention to sustainability is illustrated in the next section.

7.4.2 Multiple regression analysis

The data was analysed using multiple linear regression analysis. The purpose of a regression analysis is to relate a dependent variable to a set of independent variables (Mendenhal and Sincich, 1993). Regression analysis was seen as the most appropriate analytical technique since the goal of this study was to determine the relationship between users' behavioural intention to sustainability (dependent variable) and users' behaviour dimension, Behavioural beliefs (ATT), normative beliefs (SBN), and behavioural control beliefs (PBC) affected by sustainability-related functions in the research model (independent variables). Assumptions of multivariate normal distribution, independence of errors, and equality of variance, were first tested and there were no violations of these assumptions. Multicollinearity was not a concern with this data set, as confirmed earlier by the lack of evidence of significant multicollinearity among the research variables. Outlier influential observations were identified and the analysis indicated that there were no problems with respect to influential outliers. To examine the joint impact, a regression analysis was conducted to predict the potential effects of the research model to promote users' behavioural intentions to sustainability and investigate which sustainability-related functions and behaviour dimensions of TPB best predicted the effect on users' behavioural intention. Taking a 5% significance level (2-tailed), the results indicate that sustainability-related functions and the three TPB constructs considered in the model account for 83% of the predicted effects on the dependant variable of users' behavioural intentions to sustainability of future utility users who intend to use the model (see Table 7-13). Behavioural beliefs (ATT), normative beliefs (SBN), and behavioural control beliefs (PBC) were statistically significant.

Table 7-11 shows the beta values, indicating the individual contributions of each independent variable to the model. The independent variables ATT, SBN and PBC have beta values of 0.385, 0.459, and 0.397, which indicates that a change of one standard deviation in any variable will result in a change of 0.385, 0.459, and 0.397, respectively.

The beta weight indicated that ATT and PBC were the strongest predictors, with a level of significance of 0.004 and 0.009, respectively, indicating that these independent variables play a significant role in predicting the dependent variable; however, the direction of this effect is positive. This is followed by SBN. The beta values of all variables are positive, showing their significant positive individual contribution in bringing change to the dependent variable. The t statistic along with the beta value is a measure of the probability that the actual value of the beta is not zero. The larger the absolute value of t, the less likely that the actual value of the beta could be zero.

Table 7-11: Regression coefficients on predicting potential effects of sustainability-related functions within the research model on individual behaviour intention towards pro-environmental sustainability

Hypothesis No.	Independent Variables	β coefficient	t-statistic	P-value
H.c (1)	ATT	0.385	3.111	0.004
H.c (2)	SBN	0.459	2.484	0.030
H.c (3)	PBC	0.397	2.991	0.009
Dependent variable individual behavioural intention to sustainability; R = 0.901; R^2 = 0.912; F = 0.019; Sig = 0.000				

Table 7-11 also shows the values of the model's ability to calculate the outcome variable (the F test), value of R, the corresponding R^2, and the adjusted R^2. The value software shows the values of the multiple correlation coefficients between the independent and the dependent variables. For this model, the value of R in which all independent variables are included is 0.901. This value of R provides a measure of how well intention can be predicted from the set of scores of the independent variables. The positive value of R confirms that the three TPB independent variables in the research model can best predict the potential effects on users' behavioural intention to sustainability. The value of R^2, which is a measure of how much of the variability in the dependent variable is accounted for by the independent variables, is 0.912. This value indicates that all of the independent variables account for almost 91.2% of the variations in the prediction of model potential effects on users' behavioural intention to sustainability. The value of F is significant (smaller than 0.05), which shows that the independent variables explain the variation in the model potential effects on users' behavioural intention to sustainability. To conclude, all the values confirm the significant good fit of the model.

7.4.3 Hypothesis testing and discussion

Having confirmed the structure of the various scales in terms of reliability, dimensionality, and validity, I went on to test the hypotheses proposed in (phase III) of this research. This aimed to explore the effects of innovative sustainability related function integrated within the research model, on the users' behavioural-related dimensions and to promote their overall behavioural intention to sustainability. The main hypothesis was:

> <u>Main (H.c)</u>: The sustainability-related functionality integrated within the proposed research model will positively promote users' future 'behavioural intention' (BI) towards pro-environmental sustainability.

The main hypothesis is a synthesis of three sub-hypothesis of user behavioural related determinants (derived from TPB theory) in relation to users overall behavioural intention to sustainability. In summary, model and hypothesis testing was conducted with the effects of sustainability related function on three behavioural-related variables. The independent behavioural-related variables were: behavioural beliefs (ATT), normative beliefs (SBN), and behavioural control beliefs (PBC). This was tested with one dependent variable 'user behavioural intention to sustainability'. The sub-hypothesis H.c (1), H.c (2) and H.c (3) are as follows:

> H.c (1): The integrated sustainability related functions (integrated within the research model) positively affect user's 'attitude' (ATT) towards pro-environmental sustainability.

The results obtained (see Figure 7-4) indicate that, although the parameter sign obtained was as expected, significantly high levels were achieved ($p = 0.04$). For this reason, Hypothesis H.c (1) was accepted. On the other hand, both the sign and the explanatory capacity of the parameter relating to sustainability related functions effects on user attitude and with the dependent variable (behavioural intention to sustainability) attained satisfactory levels. Finally, the high R^2 values obtained ($R^2 = 0.912$) as well as the good fit of the model should be noted.

H.c (2): The sustainability related functions (integrated within the research model) will positively affect user's 'subjective norms' (SBN) in relation to pro-environmental sustainability.

According to the statistical results, the users' subjective norms will affect the sustainability related functions integrated within the research model and significantly affect the users' future behavioural intention to sustainability. The beta value 0.459 shows that a one-unit increase in the users' subjective norms (which resulted from sustainability-related functions) can result in a 0.459-unit increase in the composite users' behavioural intention to sustainability. This suggests that, the sustainability related functions integrated within the research model influencing their overall intention behaviour, can contribute in promoting future sustainability behaviour. Thus, H.c (2) is accepted.

H.c (3): The sustainability related functions (integrated within the research model) will positively affect the 'perceived behavioural control' (PBC) from a user point of view in relation to pro-environmental sustainability.

As analysed in the empirical results, the beta values of the perceived behavioural control variable are positive (0.397), showing that a one-unit increase in the users' perceived behavioural control will cause a 0.397-unit increase in promoting users' composite behavioural intention to sustainability. This suggests that well-designed sustainability related functions within the research model features strongly affect the positive behavioural intention to sustainability from its users.

Most of the hypotheses exceeded their significant acceptance levels, suggesting that the research innovation model with the integrated sustainability related functions provided positive results in predicting the future influence on users' behaviour intention to sustainability and promoting behaviour of saving utility resources consumption. The results are shown in Figure 7-4 (the research model and path-relationship among variables). The hypothesised paths are significant at the 0.01 or 0.05 level. Figure 7-4 displays all relationships among the studied constructs. The figure shows that 91.2% of the variance of sustainability-related functionality effects on disaggregate users' behavioural determinants and overall behavioural intention to sustainability, as a composite depended variable. Variance in model effects on users' behavioural intention to sustainability was 91.2%, which can entirely be explained by the effects on independent variables of behavioural-related constructs which includes: behavioural beliefs (ATT), normative beliefs (SBN), and behavioural control beliefs (PBC).

Table 7-13 compares the relative effects of each behaviour determinant on the dependent variables of promoting users' behavioural intention to sustainability (influenced by sustainability-related functionality). These effects were separately explained by behavioural beliefs (ATT) (26%), normative beliefs (SBN) (19%) and behavioural control beliefs (PBC) (11%). Furthermore, Table 7-14 presents a detailed insight into the rank of the influence rate of each sustainability-related functionality on users' behavioural intention to sustainability. When comparing the relative effects rate of each sustainability related functionality on users' behavioural intention to sustainability, the sustainability awareness/real-time feedback and demonstration features (mean= 4.76) were noticeably highly ranked, followed by both profile-based services of goal sitting and setting commitment of targeted resource consumption (Mean =4.71) and the ability to control and monitor utility services (mean= 4.60). The mean of 4.58 is for the feature of regional/neighbour comparative feedback and analytical functionality. It was ranked as a third sorted mean level that influences the users' behavioural intention to sustainability. In addition, the mean of behavioural influence functions of linking utility users with sustainable parties via cooperative medium (i.e. sustainable communities, policy makers, sustainable solution industries …etc.) followed, which was 4.54. Lastly, the mean of 4.49 was calculated for the functionality of avatar and user-centric recommendations services found in the sustainability-related functions within the research model. Table 7-16 presents information describing the detailed influence rank of each sustainability related functionality that contributes to promoting future user behaviour intention to sustainability.

In summary, Table 7-12 indicates that the hypotheses were significantly supported. As illustrated in the summary table, the integrated sustainability related functions provided within the innovation model will positively contribute on promoting users' future behavioural intention to sustainability and specifically to their behavioural beliefs (ATT), normative beliefs (SBN) and perceived behavioural control beliefs (PBC). The hypothesised relationship results and their values being tested are illustrated in Figures 7-4 and Table 7-12.

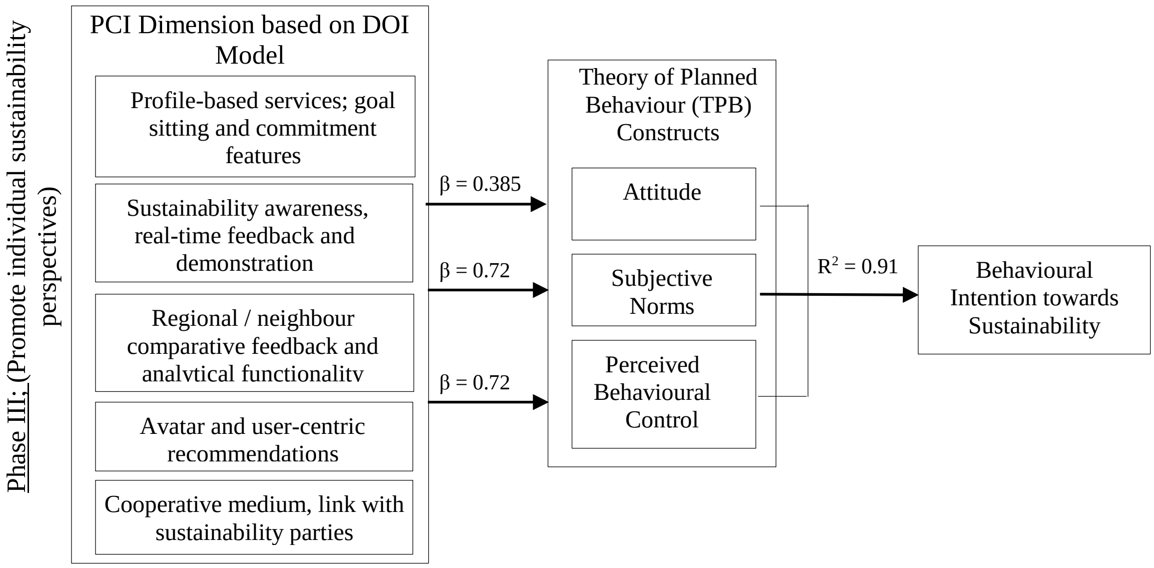

Figure 7-4 Tested results of predicted effects of sustainability-related functionality integrated within research model on promote user intention behavioural to sustainability

Table 7-12: Results of the study hypotheses tested (Phase III)

Hypotheses		Results
Main (H.c)	The sustainability-related functionality integrated within the proposed research model will positively promote users' future 'behavioural intention' (BI) towards pro-environmental sustainability.	Supported
H.c (1)	The integrated sustainability related functions (integrated within the research model) positively affect user's 'attitude' (ATT) towards pro-environmental sustainability.	Supported
H.c (2)	The sustainability related functions (integrated within the research model) will positively affect user's 'subjective norms' (SBN) in relation to pro-environmental sustainability.	Supported
H.c (3)	The sustainability related functions (integrated within the research model) will positively affect the 'perceived behavioural control' (PBC) from a user point of view in relation to pro-environmental sustainability.	Supported

Table 7-13: Mean rank of predicted influence of sustainability-related functionality on users' behavioural intention

User's behavioural-related dimensions	Sorted Means
Attitude (Behavioural belief)	4.93
Subjective Norms (Normative belief)	4.81
Perceived behavioural control (Control belief)	4.69

Table 7-14: Mean rank of predicted influence of sustainability-related functionality on user behavioural intention

Items of sustainability-related functionality	Sorted Means
Sustainability awareness, real-time feedback and demonstration	4.76
Profile-based services; goal sitting and commitment features	4.71
Controllability and monitoring, services	4.60
Regional/neighbour comparative feedback and analytical functionality	4.58
Cooperative medium and link with sustainable parties (sustainable communities, policy makers, sustainable solution industries …etc.)	4.54
Avatar and user-centric recommendations	4.49

Brief summary and discussion

This study proposed and tested the potential effects of sustainability-related functionality within the research model on the users' behavioural intention to sustainability. This is in the context of utility management services on the virtual enterprise environment. Since it is the purpose of phase III of this research theoretical validation framework, this section evaluates the potential effects of the research model on user behavioural intention to sustainability.

The previous theory of TPB was employed in predicting the influence of sustainability related functions on the users' behavioural intention. This study differs from past research efforts by investigating the role of technology on prompting users' individual behaviour to sustainability, while the aims remain the same with regards to exploring the users' behavioural intentions, urging utility users to save energy consumption, and promoting the users' behaviours to be pro-environmental. Previous studies mostly focused on the general design of techniques or intervention mechanisms to enable public engagement in sustainable lifestyle or changing individual behaviours (Staats et al., 2004, McMakin et al., 2002, Völlink and Meertens, 2006). A large number of studies of individual behaviour to pro-environmental sustainability have concentrated on the use of informational intervention in promoting the users conservation of natural resources (Abrahamse et al., 2005). This has included studying the effects of information prompts (Luyben, 1982), personalised tailored information and social marketing (e.g. Abrahamse (2007b), Daamen et al. (2001), and Thogersen (2007)), goal setting and commitment techniques (e.g. Katzev and Johnson (1983), and Katzev and Johnson (1984)), and social influence of other behaviour to sustainability (e.g. Schultz et al. (2007) and Abrahamse et al. (2005)).

Previous studies mainly focused on designing persuasive technology to promote user behaviour to natural resource consumption (e.g., Wattson (2013) or Energy Orb (Martinez and Geltz, 2005)). Their strategies and intervention mechanisms focused on technology innovation and how it can affect individual behaviour to sustainability (e.g., Midden et al. (2008), Pousman and Stasko (2006), He et al. (2010), DiSalvo et al. (2010), Froehlich et al. (2010), and Chisik (2011)). This study found a similar significant positive influence on users' sustainable behaviour intention, thus predicting the research model as a comprehensive and integrated shared environment for information exchange between utility parties. It also enables the facilitating intervention techniques that promote individual behaviour change.

This study is pioneering with respect to predicting potential influences of integrated sustainability-related techniques on individual sustainable behaviour. This study is, therefore, unique as a newly emerging integrated virtual enterprise environment that integrates utilities parties in single comprehensive utility services. It believes that such frameworks can engage people in sustainability aspects and enable individuals to be involved in sustainability activities. The results of this study differ in its perspective from those of previous studies with regard to individual sustainability improvement. For instance, this study enables a user-centric innovative and integrated online service delivery approach that is embedded in the design of the integrated 'one-stop' utility management over the virtual enterprise environment. It was mainly designed to be a values-driven framework by providing public service values to the users, as well as for all utility stockholders. Specifically, it was designed to promote environmental sustainability and to facilitate collaboration activities to achieve the noble goal of saving the environment.

In this study, by using the research model, the significant effects of sustainability related techniques on the users' behavioural intention to pro-environmental sustainability were observed. This is consistent with the research hypothesis and the test results have demonstrated a significantly positive relationship observed on the individual behavioural intention. In this direction, this study further validates the disaggregate behavioural related dimensions (attitude, behavioural belief, perceived behavioural control) of that factor in understanding sustainability-related functionality effects on the individual overall behavioural intentions to sustainability. The results of this study clearly support the notion that higher levels of integrated innovative technology with value-added service for all utility stockholders and utility users can have significant effects on promoting individual behaviour intention to sustainability. Previous studies have also confirmed that individual behaviour has major effects on sustainability.

7.5 Chapter summary

Online services and online service websites of business agencies are continuously in competition with each other as they strive to increase their number of online users. The service providers of utility management services on the Internet face the question of how they can increase their online users. These online utility service providers need to identify how they can attract more users by paying more attention to their users' specific online service needs. Similarly, questions arise about how these websites distinguish themselves and how they attract users to adopt these online services, or how they enhance the utilisation rate of their online services usage by utility users. Thus, this study has evaluated and highlighted the noteworthy features of the innovation of an integrated virtual enterprise utility management framework that significantly influences the positive perception of utility users and their intentions to use these online services. Therefore, this chapter has focused on investigating the effects of such features on individual sustainability behaviour. It has also provided the theoretical validation result of the model from the individual evaluation point of view. Both validation phase II and phase III were designed to validate the research model using a specific theoretical model, as described in Chapter 3.

In phase I, the research findings confirm that the users need comprehensive utility management for all utility services by initiating an integrated virtual enterprise utility management framework that provides value-added services to all utility stockholders and to the utility users specifically. The revolution in the service delivery paradigm in utilities should move towards an integrated virtual enterprise utility management of service delivery approach that stresses the users' perspective as the main factors affecting their perception of adopting the online services. The prominent features highlighted by the respondents are supposed to be crucial for the success of the innovation of integrated virtual enterprise utility management model.

It can be concluded that, by adopting a customer-centric strategy, the developers of Internet-based utility services should devote significant attention to developing integration standards of online services provision of utility services across all utility agencies as well as a user-friendly, effortless, convenient, and co-operative communication environment because these aspects can enhance value-added services as well as increase the number of users, thereby increasing the rate of user technology acceptance and online service adoption. The findings based on sample responses provide strong empirical evidence for the explanatory power of the integrated virtual enterprise utility management conceptual framework. The knowledge related to factors of perceived characteristics of the innovation as a major predictor of the utility user's intention to use the innovation can support the agencies responsible for online service delivery in utilities, with important guidance for successful online services delivery and a greater focus on the utility users' demand-side. This study has successfully identified the key of integrated virtual enterprise utility management factors that play a major role in users' willingness and intention to accept the innovative model. The results show that seven factors are important for users' perception of innovation acceptance in online utility management context. The inter-relationships among PCI and the integrated virtual enterprise utility management model and users' perception about intention to accept the innovation were explored. Theoretically, conceptual linkages of the impact of perceived characteristics of the integrated virtual enterprise utility management model on users' perception were established and empirically tested. All of the results were significantly positive but the result of predicting the influence of OU on their intention to accept and use the innovation was unexpected

The results of this study show that utility users are mainly concerned about their interaction with multiple sources of online service providers. They need to interact with a single point of online service providers with the least possible effort needed to perform their utility transactions online. For this purpose, these utility service providers should strive for the best integrated online service provision informed by users' needs. Future research should expand the scope of the study of the technology adoption from the service providers' point of view to cover the recent paradigm of online service delivery that enables all utility parties to interact through a single environment and achieve the purpose of the comprehensive management of national utility resources. In addition, more research should be undertaken to explore the integration and operability of service delivery in utilities across different administration boundaries between agencies to deliver a unified environment as the basis for future integrated 'one-stop' utility management. For future successful online service delivery, the causal effects of the users' perceived characteristics of the innovation on users' satisfaction and services adoption should be considered.

These findings provide important insights into utility users' perspectives of online services while framing the online service delivery strategies and policies. The study clearly emphasises the need for utility stakeholders to understand that the online utility services supplied over the Internet should not be only tailored to the service providers' supply-side perspective of online utility service but they must also consider the users' demand-side in order to promote individual sustainability behaviour. They should also consider the individuals' preferences, goals information needs, and performance expectations.

In phase II of the validation framework, the chapter examined the effects of sustainability-related functionality in the model, on individual behaviour intentions to sustainability. Section 7.4 was evaluated and the hypothesis was analytically tested with regard to the research objectives and advanced statistical methods were used. The section finishes by providing an analysis and predication of the model effects on individual behavioural intention to pro-environmental behaviour. The results pave the way to summarising the main strengths and opportunities that can contribute to promoting individual behaviour. The results described in this chapter were interpreted in light of theoretical expectations found in Chapter 3, of other results of this study, as well as of the findings of previous research. The next chapter provides an overall conclusion, summarising the results by highlighting the extent to which the research objectives were met.

Chapter 8: Discussion, Conclusion and Future Works

Introduction, research summary, addressing the research aim, objectives and research questions, research contribution to the body of knowledge, recommendation for future research and final summary.

8.1 Introduction

This chapter concludes this thesis and summarises the research findings. The first two sections will present an overall summary of the research work with a brief discussion on the research findings in order to meet the aims and objectives and to provide answers to the research questions. This is followed by a brief discussion on how the research contributes to the current body of knowledge for the different research areas related to the research topic, highlighting directions for future research. A summary of the final conclusions is then outlined.

8.2 Research Summary

Today, businesses, public institutions and private sector agencies, together with individuals have come to realise very quickly the potential benefits that such a technology can provide (Fang, 2002). The underlying advantages brought about by the Internet go far beyond its ability to provide information services to beneficiaries and are rather to be found in the realisation of more tangible benefits such as, better service delivery to customers, enhancement of business processes as well as lowering costs and improving outcomes (Ancarani, 2005). At present, there is a pressing need to improve services beyond the basic eService delivery concept when dealing with the provision of electronic services within the private sector. The most dominant mode of competition between private organisations is the intensive effort invested in modernising eService provision in order to attract their customers (Asgarkhani, 2005) and the initiative of designing revolutionary service-delivery strategies has been taken, in which the development of an innovative eService delivery approach is an important element of their modernisation agendas.

As concluded from the literature review, numerous recent service delivery initiatives display a major shift in their strategies from the organisational supply-side service delivery approach to a focus on ‘user-centric’ service provision, which scholars consider an important shift in coping with the user demand-side and in order to attain their satisfaction (Botterman et al., 2003, Lassnig and Markus, 2003, Zhang et al., 2005, Christopher G, 2004, Tung and Rieck, 2005, Seifert and Petersen, 2002, Christopher G, 2005). At the same time, others have considered this approach a crucial step towards eService provision that would be capable of coping with customer needs and meet their service expectations (Scholl, 2006, Raymond et al., 2006). In addition, they consider it useful for achieving better user technology acceptance, innovation adoption and satisfaction (Christopher G, 2004, Graafland-Essers, 2003, Hinnant and O'Looney, 2003, Wendy, 2003, Tung and Rieck, 2005).

In the related field of eService delivery strategies, several studies point out the importance of considering the emerging concept of a ‘one-stop’ integrated services delivery paradigm in the implementation strategies of eServices that target the satisfaction of customer-needs (Maria A, 2002, Wimmer, 2002b, p.149). The ‘one-stop‘ electronic service delivery paradigm demonstrates its importance in playing a role in and capacitating the creation of a virtual delivery environment that enables the elimination of existing boundaries between all stakeholders including service providers and users. This rather favours interaction and information sharing between different fragmented parties, thus providing a comprehensive virtual service that is integrated and directed towards user needs. This new kind of virtual environment offering the innovation of a single point of access to online service provision and information content can be seen as an effective bridge over the physical and logical boundaries between organisations themselves and end users.

In the case of utility service management, this research evidently shows that users tending to welcome the technological revolution towards providing a single point of access to knowledge-based information sources that would enable them to interact with ‘an integrated virtual enterprise utility management’ innovation (or ‘one-stop’ utility management model) as a single point of access to utility service management and a source of knowledge-based information capable of delivering value-added services to users and all utility stakeholders. Stakeholders tend to expect a comprehensive integrated services delivery approach of online services that has the same level of quality of services and responsiveness experienced generally when dealing with these similar online service providers. This thesis consequently contributes to the body of knowledge by moving the spotlight onto the holistic view that considers consumer needs by focusing on the customer outside-in perspective of service innovativeness. It highlights the need for electronic utility services intended to benefit the customer, as well as other stockholders and proposes an initial roadmap aimed at delivering an integrated 'one-stop' utility management solution. It aims to show how it would be possible to improve user experience and service usability with a holistic framework that delivers benefits to all utility stakeholders via better electronic services within the shared environment.

In practical terms, the research was structured in four sequential stages (one theoretical stage and three other empirical stages) ordered in logical sequence as depicted in chapter 4 and was appropriately designed to tackle the research problem, achieve the research aims, objectives and answer the research questions.

The initial stage was devoted to defining the research problem, outlining the conceptual model, developing a theoretical validation framework and research questions with a formulation of the related hypothesis of the study as explained in detail in chapter 3. This research was undertaken in the context of technology adoption and the use of technology to enable the encouragement of individual sustainable behaviour. The emphasis is on the literature review with regards to the concepts, principles and major factors affecting user technology adoption and the influence of technology on individual behavioural intentions towards sustainability as well as the search for relevant theories or models that will be appropriate to the objective of this study. The literature review was conducted in order to provide an increased understanding of the research topic and to support a process of conceptualising the essential related research areas of user task technology fit, technology adoption, dimensions of behaviour and individual sustainability issues as well as allowing for the evaluation of different aspects of the study related to existing studies in several research domains. The findings at this stage of the research were critical to the identification of aspects related to the research topic and the determination of the main variables that have an impact on the research problem. The findings of the literature review were also used to develop the data collection method and define the measurement constructs of the questionnaire instrument.

The second stage forms the empirical part of the research. It was conducted in a Saudi Arabia, involving internet-user, and within the utility management context. This stage endeavoured to empirically investigate the internet-users' perceptions of task-technology fit, new technology innovation adoption, barriers, trends and difficulties for both existing and future technology innovation as well as an electronic service delivery approach, using a quantitative questionnaire survey instrument and explored the user perception of the relationship between the technology innovation characteristics and their satisfaction. As a result of this stage, the research model of user's perception of the technology-fit and expected net-benefits was developed using an empirical investigation into the research problem that found its basis in the main variables that were obtained from an extensive literature review of related studies and theories in the same field. The model was also revised according to the findings of the results obtained at this stage to represent the user perspectives of technology-fit and benefits in the final research model.

In the third stage of this research, a specific mocked-up prototype system was created as a further step to an empirical validation of the research model of the study. It was employed to enable the researcher to present the research concepts alongside the related concepts regards the intended users and in order to conduct the empirical validation survey with an end to investigating the user evaluations of the different concepts of the research model so as to meet the aim of the last phase of this study.

In the last stage, this research analytically validated the user perspective towards the new technology innovation, predicted their willingness to adopt the platform of the proposed technology innovation and verified the user evaluation of the validity of the proposed platform as regards to its effect on individual sustainable behaviour.

In practical terms, the research aimed to theoretically investigate user perspectives towards dimensions of the newly proposed innovative model and study the factors that impact on their intentions to accept and adopt the new platform of an integrated online utility management service, as well as to determine the value of the innovation from the users' perspective. A development of a specific theoretical framework was developed in this thesis and underpinned by several related theories including theories of task-technology-fit (TTF) (Goodhue, 1995), DeLone and McLean's modified model of information system success ('net-benefits') (Delone, 2003), the technology acceptance model (TAM) (Davis, 1985), diffusion of innovation (DOI) and perceived characteristics of innovation (PCI) (Moore and Benbasat, 1991), which is widely used in the field of information systems (Straub et al., 1999, Moore and Benbasat, 1991, Plouffe et al., 2001, Tornatzky and Klein, 1982, Van Slyke et al., 2004).

The overall contributing outcomes of this research, were the investigation of different aspects related to the new technology innovation, explaining the user perception of technology fit, benefits, acceptance, adoption and prediction of the user willingness to use the formulated platform in a utility management context for the promotion of sustainable behaviour at an individual level. However, to the best of the author's knowledge, no previous studies have been undertaken in this domain that propose user-centric integrated services for utility management in a virtual enterprise environment. Therefore, this study has taken the initiative in formulating a new integrated services delivery model in a virtual enterprise environment that is viewed as a user-centric comprehensive solution capable of meeting user demands of achieving efficient utility management using online services in order to accomplish all of the parties' goals of promoting environmental-sustainability, energy and national utility resource saving. In the following section 8.3, the contributions to the research aim, objectives and answers to the research questions are summarised.

8.3 Addressing the Research Aim, Objectives and Answering the Questions of the Thesis

As stated in the previous section, the main objective of this research is to investigate the user standpoints towards the creation of a user-centric innovation of service delivery for utility management intended to connect utility stakeholders via an integrated environment, enabling the efficient utility management and sharing of related information and services with individuals as well as facilitating a collaborative approach to promoting environmental sustainability. Therefore, the 'integrated virtual enterprise utility management' platform and associated eService delivery approach (or 'one stop' model) of this study are referred to as the technological framework that includes information, systems and services that provide an opportunity to support utility users in carrying out the task of managing their utility services (Gold et al., 2001).

Accepting the presented 'integrated virtual enterprise utility management' model and associated eService's delivery approach (or 'one stop' model) in a utility management context leads to the question of how providers of such services can create a user-centric platform that affects the user perception of benefits, acceptance, technology-fit and future user technology adoption. Issues of user acceptance of the technology innovation model can be seen from the perspective of defining an integrated user-centric electronic service delivery approach that enables the continued use of technology innovation services and provides value from the users' perspectives (Gronroos, 2000); (Ulaga and Eggert, 2005). To achieve this goal, this thesis contributed to the body of knowledge in this area by providing an answer for the identified overarching research question:

> *"Does the creation of an online "one-stop" user-centric and integrated virtual enterprise utility management platform positively affect user perception of technology fit, acceptance and innovation adoption, while promoting individual intention towards environmental sustainability?"*

Given that the integrated virtual enterprise technology innovation and services delivery paradigm for utility management constitutes a new model, the necessity for an empirical evaluation taking into account similar studies in the field has been underlined by researchers. However, such an evaluation has not yet been carried out and the area remains a new domain. This study builds upon the existing work to provide a deeper and more theoretically driven investigation. To the best the author's knowledge, there is no framework or even empirical investigation of an 'integrated virtual enterprise' technology (or 'one stop' model) in a utility management context and the theoretical framework outlining how such a study would be conducted is still non-existent. Thus, this research was proposed in order to overcome these challenges and fill the gaps of knowledge by means of formulating the conceptual model and undertaking three empirical exploration phases (three sequential stages) of the user perspectives regards the creation of an 'integrated virtual enterprise' technology platform by using appropriate theories of TTF, DeLone and McLean's model (net-benefits), TAM, DOI, PCI, and TPB theory. It was hypothesised that for a successful user-centric utility platform, that might involve the integration of services and information from multiple sources, a higher user's value perception will be accomplished when the formulated technology platform is created with some technological attributes suitable for specific characteristics of user task needs. Thus, the technology innovation model provides overall value from a user perspective.

The following sections present a summarised discussion of the research contribution in relation to the three areas of research focus and provides answers the sub-research questions.

Phase I: User-perceptions, perceived technology-fit and potential net-benefit outcomes (research question 1 and 2)

This phase of the research was devoted to providing an answer to two sub-research questions (1 and 2) of this study. In the initial part, a fundamental informational background about local internet users profile was established by providing an answer the first research question:

> RQ 1: What are the socio-demographic, internet use, public eService adoption, and behavioural characteristics and profile of local internet users in the city of Riyadh (i.e. potential users of the proposed platform)?

It was identified early in chapter 1, that building a necessary background of information about respondents' socio-demographic characteristics, their behaviour in relation to using the Internet (prior-experience of the Internet, frequency of internet use, access location and use purposes) and their behaviour in relation to public eService usage (awareness, prior-experience, behaviour and adoption) was an essential step towards providing information for the subsequent research.

As one of the primary goals of this research is the evaluation of user perceptions towards the creation of an 'integrated virtual enterprise utility management' platform (or 'one stop' model), an appropriate theoretical framework and information systems theory was developed in this study to identify situations in which a more advanced conceptualisation of integrated services is formulated to facilitate user technology satisfaction. The formulated theoretical framework was used to evaluate user perceptions across all the core components of the conceptual model of the platform from 'technology-fit' to the expectation of 'net-benefits' with a particular emphasis on the role of TTF on user perceptions of technology innovation benefits. Specifically, this was used to answer the second research question as stated in chapter 1:

> RQ 2: What are users' perceived technology-fit and benefits in relation to the creation of an 'integrated virtual enterprise utility management' innovation (or 'one-stop' technology innovation platform)?

As described earlier in the methodology in chapter 4, to achieve the research objectives and answer the research questions, the survey was conducted and related data was collected from 1142 people living in the capital city of Saudi Arabia (specifically, Riyadh city). Afterwards, the survey data was analysed using different statistical techniques ranging from simple to advanced analytical methods, in order to explore, summarise and interpret the data providing an understanding of user perceptions across all related aspects regards the creation of the research technology innovation model and to answer the first two sub-questions of this study (phase I).

To answer both research questions (RQ1 and RQ2), different steps and types of data analysis were carried out. In the preliminary stage of the data analysis process, a descriptive analysis method was initially used. It was used in the first stage of the data analysis to report on descriptive statistics pertaining to respondents' socio-demographic characteristics, their behaviour in using the Internet (prior-experience of the Internet, frequency of internet use, access location and use purposes), and their behaviour in relation to public eService usage (awareness, prior-experience, behaviour and adoption). In addition, it was employed to provide a statistical comparison with the relevant national study of internet user's characteristics in Saudi Arabia to test the representativeness of study data with the wider population. It was identified that it is essential to survey the technological and behavioural context related to the research question and to build a profile of internet-users in a local context before investigating the users' perception regards the creation of a research technology innovation platform.

In the first stage of answering the second research question (RQ2), section 6.3.1 of chapter 6 starts by conducting a descriptive data analysis in order to describe the respondent's perspective of technology-fit and net-benefits of the research model using the theoretical framework, which is based on the constructs adopted from theories of TTF and the McDeloan information system success construct named 'net-benefits'. The purpose of conducting a descriptive data analysis in this situation, was to determine how electronic utility services are currently perceived by most individuals today and precisely what task needs and technological variables are impacting their intention to use such services. The investigative analysis of user 'technology-fit' perspectives in this study constitutes a synthesis of two research dimensions identified as 'innovation-technological-characteristics' and 'task-characteristics' (Goodhue, 1995), which were suggested as effective measurements of the user technology-fit perspective affecting user intentions, specifically at a prior stage of using such technology innovation.

The descriptive results above show that respondents had a high positive perception of the proposed 'technological-characteristics' of the research model. This is concluded from the analysis results yielded from most underlying items of the 'technological information dimension', 'system dimension' and 'online services delivery dimension' as presented in Chapter 6, which provides an indication that the majority of the respondents welcomed the creation of an 'integrated virtual enterprise utility management' platform (or 'one-stop' model) in a utility management context and perceive the technology characteristics fit with their task-needs of managing their utility services online. The findings reveal that 'technological characteristics' seem to have a major impact on influencing positive user perceptions of 'technology-fit'. This finding can be explained by the descriptive analysis of user perceptions towards the different items making up the 'technological-characteristic' dimensions of the proposed platform as described in chapter 6. The results show that the 'technological characteristics' of the platform of most interest to the users was both the 'informational dimension' and the 'online services delivery dimension' followed by interest in the 'system dimension'.

The findings of the analysis for these three constructs and the underlying individual items which measured respondents' perception of 'innovation-task-characteristics' of the proposed innovation platform revealed that the innovation's capacity to support three task characteristics including, informational, administrative and transactional tasks were the most strongly correlated factors with user positive perception towards the innovation technology characteristics.

Furthermore, the findings imply that a 'sustainability-related functionality' as a 'task-characteristic' of the proposed platform has a high level of perceived importance, which is reflected by the significantly high statistical analysis results. It was concluded that the initially descriptive analysis results support the hypothesis that task-characteristics of the proposed 'integrated virtual enterprise utility management' (including the 'sustainability-related functionality') were welcomed by utility users and have a positive relationship with their perceived 'technology-fit' of the proposed platform with their needs.

The second aim of prime importance to the second research question (RQ 2) of this study was the investigation of user perceptions of the potential ‘net-benefits’ of the proposed ‘integrated virtual enterprise utility management’ platform based on the relationship between the innovation technology characteristics (‘technological characteristics’ and user ‘task-characteristics’) and user net-benefit perspectives as theoretically defined in Chapter 3. In this regards, to answer the second part of the research question (RQ2), this research developed a well-defined theoretical framework underpinned by the relevant literature to evaluate the user perspective of potential net-benefits of the conceptualised technology innovation model. The research differs from that of previous scholars who employed different empirical methods to examine information technology benefits without making any attempt to underpin such a framework theoretically (Torkzadeh and Doll, 1999, Saarinen, 1996, Bonner, 1995, Gable et al., 2008).

Following this process, both the survey instrument and data analysis (descriptive and advanced statistical analysis) were guided by the theoretical framework in order to explore the effects of the proposed technology innovation’s characteristics on the users perceptions of potential ‘net-benefit’ outcomes, in accordance with the ‘net-benefits’ measurement dimensions (see Chapter 6 for details). The descriptive findings for the nine aspects of the ‘net-benefits’, showed that an overwhelming amount of the respondents welcomed the creation of an ‘integrated virtual enterprise utility management’ model and were agreed on the remarkable promising benefits that it would provide. In fact, more than 87.8% of respondents strongly agreed or agreed to its potential net-benefit and the majority of respondents were generally very optimistic towards the promising ‘net-benefits’ of the proposed technology innovation platform.

The preliminary data analysis was employed in this research to describe the respondent’s perception of ‘technology-fit’ and ‘net-benefits’ of the research model in relation to the model’s attributes, in order to provide a necessary background for further data analysis to answer the research question and test the hypothesis. Afterwards, two advanced analytical approaches have been employed with an aim to testing the research question (RQ2) and associated hypothesis as formulated previously in chapter 3. The first analysis included using bivariate correlation statistical methods to explore the relationships between all independent variables of the proposed model’s dimensions and the dependent variables of user perceptions of ‘technology-fit’ and ‘net-benefits’. This was followed by a second analysis where an advanced statistical data analysis method of multiple regression analysis was employed to answer the research question, test related hypothesises and achieve the first objective of this research (phase I).

It is concluded from the data analysis results that all the values confirm the significant positive effects of the proposed model on the overall user perception in relation to the ‘net-benefits’ and technology-fit of the model with their utility management task needs (see Figure 6-12).

The findings of the advanced analysis indicate that there is a significant positive relationship between all dimensions of the proposed platform innovation characteristics (‘technological-characteristics’ and ‘task-characteristics’) and the user perception of ‘technology-fit’ and ‘net-benefits’. The findings support the assumption that the proposed technology innovation with more user-centric characteristics will potentially influence users’ perception of ‘technology-fit’ and ‘net-benefits’, which may lead in turn to a positive user evaluation and indeed their overall satisfaction.

Phase II: User Acceptance and Influence on Individual Sustainable Behaviour *(Research question 3)*

Next, (phase II) the research focuses on achieving one of the main objectives of this study by exploring users’ willingness to accept the use of the ‘integrated virtual enterprise utility management’ platform and the associated eService delivery approach (or 'one stop' model). The third research question associated with this objective was presented in chapter 1 and is formulated as follows:

> RQ 3: Can a proposed model of ‘integrated virtual enterprise utility management’ be appropriate for utility users, and effectively accepted for utility management activities?

This research aims to answer the question and investigate user acceptance of the proposed innovation platform in the context of online utility management services. Several different relevant theories of technology acceptance and diffusion of innovation adoption were incorporated with a view to presenting an appropriate comprehensive theoretical model for validating the user intention towards the proposed platform. As described in chapter 3, a critical review of previous literature was conducted in order to specify which theories and variables are related to this research model of technology acceptance and individual behavioural intentions. During this literature review, the researcher identified those studies that could inform the formulation of the research's theoretical validation framework in the context of eServices and utility management over the Internet. As a result, user technology acceptance, innovation adoption theory and perceived innovation characteristics measurement instruments form the theoretical framework underpinned this research. It was assumed that user technology acceptance is related to perceived innovation characteristics and that adoption tends to be influenced by the attribute of technology innovation.

In practical terms, the theoretical validation framework and measurement dimensions of user technology acceptance and adoption intentions inform the development of the research questionnaire that was implemented amongst utility user residents of Riyadh city (Saudi Arabia). The data collected for this study was analysed using specialised statistical analysis software (SPSS), where the analysis consisted of assessing whether each of the model components, comprising the conceptual platform, were related to the user's technology acceptance and its effects on their adoption. This is followed by the pre-data analysis results, which are a preliminary stage to prepare the data for advanced statistical analysis and to confirm the structure of the various measurement scales in terms of reliability, dimensionality and validity. Afterward, the researcher went on to answer the research question (RQ 3) and test the related hypotheses exploring the utility users' intention to accept the innovation platform. A regression analysis was used as an appropriate analytical method to achieve the goal of this study of determining the relationship between users' intention (dependent variable) and the 'integrated virtual enterprise utility management' platform dimensions (independent variables). In addition, it was used to examine the joint impact and to identify which perceived characteristics of innovation best predicted the users' acceptance.

The findings indicate that there was a 94.7% variance in users' perceptions of the intention to accept the 'integrated virtual enterprise utility management' platform (or 'one-stop' model). The users' intention to accept the innovation was separately explained by 'perceived usefulness' (26%), 'ease-of-use' (19) %, 'communicability' (13%) and 'trialability' (11%). In addition, regarding users' acceptance of the innovation, 22% was explained by 'compatibility', 13% by 'compatibility with prior-experience' and 9% by 'compatibility with values'. Another 9% was explained by 'measurability'. The data analysis results indicate that the seven characteristics of innovation constructs considered in the validation model account for 78% of utility user's intentions to use the innovation platform.

The overall conclusion of the results addressing the third research question (RQ3) of this study is that users had a positive intention to use an 'integrated virtual enterprise utility management' platform for managing their utility services online.

The results of this research clearly support the notion that greater benefits of online service value for users can significantly affect attitudes of intention to accept the innovation. This finding is consistent with previous studies in technology acceptance research (Goodhue and Thompson, 1995, Igbaria et al., 1997, Agarwal and Prasad, 1999). In addition, this finding is in line with previous studies, which assert that providing user accepted services are important factors for implementing public online services (Venkatesh et al., 2003).

Phase III: Influence on Individual Sustainable Behaviour *(Research question 4)*

The third phase of this research was the evaluation of the potential platform's effects on user's sustainable behaviours. This aimed to explore the effects of an innovative sustainability-related function integrated within the research model; on the users' behaviour-related dimensions and to promote their overall behavioural intention's to embrace sustainability in the context of utility management services. The related research question was:

> RQ 4: What is the expected role of the sustainability related functionality within the proposed platform on the user behavioural intention towards environmental sustainability?

In this research, prior to answering the research question and testing the hypothesis, an intensive literature review was conducted in order to understand how individual behaviour theories could be exploited to achieve pro-environmental behavioural improvements. This study differs from past research efforts by investigating the role of technology on prompting users' sustainability related behaviour at an individual level, while the aims remain the same with regards to exploring the users' behavioural intentions, urging utility users to save energy consumption and promoting the users' pro-environmental behaviours. Previous studies mostly focused on the general design of techniques or intervention mechanisms to enable public engagement in sustainable lifestyles or changing individual behaviours (Staats et al., 2004, McMakin et al., 2002, Völlink and Meertens, 2006). A large number of studies of individual's pro-environmental/sustainability related behaviours have concentrated on the use of informational intervention in promoting the user's conservation of natural resources (Abrahamse et al., 2005). This has included studying the effects of information prompts (Luyben, 1982), personalised tailored information and social marketing (e.g. Abrahamse (2007b), Daamen et al. (2001), and Thogersen (2007)), goal setting and commitment techniques (e.g. Katzev and Johnson (1983), and Katzev and Johnson (1984)) and the social influence of other behaviours on sustainability (e.g. Schultz et al. (2007) and Abrahamse et al. (2005)).

It was concluded from previous studies, that the focus has mainly been on designing persuasive technology to promote user behaviours regards natural resource consumption (e.g., Wattson (2013) or Energy Orb (Martinez and Geltz, 2005)). Their strategies and intervention mechanisms focused on technology innovation and how it can affect an individual's behaviour regards sustainability (e.g., Midden et al. (2008), Pousman and Stasko (2006), He et al. (2010), DiSalvo et al. (2010), Froehlich et al. (2010), and Chisik (2011).

This research differs in its perspective from those of previous studies with regard to sustainability improvements at an individual level. For instance, this study enables a user-centric, innovative and integrated online service delivery approach that is embedded in the design of the integrated 'one-stop' utility management over the virtual enterprise environment. It was mainly designed to be a value-driven framework providing public service values to the users, as well as for all utility stockholders. Specifically, it was designed to promote environmental sustainability and to facilitate collaborative activities with an end to achieving the noble goal of saving the environment. The focus was on building a comprehensive integrated virtual enterprise utility platform to provide superior benefits to the promotion of collaborative individual sustainable behaviour change.

With an end to validating the proposed platform and its effects on individual's sustainable behaviours, an appropriate theoretical validation framework as formulated in chapter 3 underpinned this research. After the formulation of the validation framework, a correlation statistical analysis method was conducted as a preliminary stage of answering the research question and to analyse, measure and describe the relationship between the sustainability-related functions within the research platform and its potential effects on promoting users' behavioural intention's regards sustainability. As described in chapter 7, the correlations analysis was conducted among the three TPB constructs (namely, behavioural beliefs, normative beliefs and behavioural control beliefs) and the independent variable of individual behavioural intentions towards sustainability. The findings show that, the three behaviour intention determinants were positively correlated with the dependent construct of users' behavioural intention towards sustainability and all were statistically significant, which provides an initial indication that the proposed 'integrated virtual utility management' platform supports positive individual behaviour towards pro-environmental sustainability.

Afterwards, a regression analysis was conducted to examine the joint impact and predict the potential effects of the research platform in promoting users' behavioural intentions. The statistical analysis results suggest that the research innovation platform with the integrated sustainability-related functions has a positive influence on users' behavioural intentions towards sustainability and promoting utility resources consumption saving. The results evidently show that, sustainability-related functions and the three TPB constructs considered in the model account for 83% of the predicted effects on the dependant variable of users' behavioural intentions towards sustainability in terms of future utility users who intend to use the proposed platform. Thus, this research believes that by using the proposed research platform in the future, the significant effect of sustainability-related techniques on the users' behavioural intention towards pro-environmental sustainability would be observed. This is consistent with the research prediction analysis findings that reveal a significantly positive relationship exists with regards the individual behavioural intention.

The overall findings reveal that the newly emerging integrated virtual enterprise environment that integrates utilities parties in a single comprehensive utility service would have an impact on engaging people in aspects conducive of sustainability and enable individuals to be involved in sustainable activities.

8.4 Research Contribution to the Body of Knowledge

As described in chapter 1, the main aim of this thesis was to investigate the potential role of the creation of a 'user-centric' and 'integrated virtual enterprise utility management' framework in a utility management context on bridging the gap between technology innovation and user's perception of benefit, technology-fit, acceptance and technology innovation adoption, as well as to enable the promotion of individual pro-environmental sustainability behaviours. This research was motivated by the absence of literature and studies offering a comprehensive unified view of user-centric utility management services over the Internet that has the capacity to promote individual sustainable behaviour. This literature gap is concerning since several eService implementation initiatives are facing the lack of user services adoption and miss the opportunity offered by the role of technology in encouraging sustainability. Furthermore, despite the existing extensive research that studies users' eService adoption in many information system research fields, the researcher argues that there were no previous studies that suggest an integrated user-centric utility management service delivery platform or examine user eService acceptance and adoption in a utility management context. Moreover, they fail to realize the benefit of use of a collaborative and internet-based integrative platform combining all utility stakeholders to be a mean of intervention that will contribute in promote individual sustainable behaviour. In this context, this thesis had made several valuable and innovative contributions to the body of knowledge in different research areas in relation to the research topic. Specifically, this research presents significant contributions ranging from improving electronic service delivery strategies, technology acceptance and adoption, to the extent of promoting individual sustainable behaviour. The main research contributions can be briefly described as follows:

Contribution 1: This research contribute in addressing the existing gap in the literature in relation to the topic of this research. Firstly, it was contribute to research field by building a model that can inform e-organisations of the importance of implementing a user-centric and integrated electronic services platform that focuses on improving user technology acceptance and services adoption in a utility management context. This research identifies and addresses gaps that exist between organisations' efforts to implement and diffuse eServices and users' expectations for adoption and use. Also, the conceptual model proposed in this research (as outlined in chapters 2 and 3) will (a) enable e-organisations to identify the appropriate user-centric service delivery paradigm along with key technological characteristic features that can facilitate adoption from user perspectives, which in turn, (b) contributes to the body of knowledge in terms of its impact on the aspects of user technology-fit, perceived benefits, acceptance and service adoption. The proposed platform was confirmed to contribute to the existing sources of knowledge as an innovative integrated framework for user-centric utility management services. The proposed framework encapsulates a review of technology innovation and eService delivery approaches under several themes that includes: a) eService delivery paradigms,

b) technology-fit dimensions, c) information system success and benefits, d) technology acceptance and services adoption as well as the e) role of technology in promoting individual's sustainable behaviours.

Additionally, in practical terms, this research has contributed to the practitioners by proposing a user accepted integrated virtual enterprise platform that will enable responsible organisations a means of providing online utility management services to utility users, in addition to providing a comprehensive understanding of the different technological innovation dimensions affecting the success of existing initiatives and an elaboration of the move towards successfully implementing the integrated electronic services framework so that technology acceptance can be achieved. The contribution of the proposed model in this research will serve as a framework for the further development of a comprehensive virtual enterprise platform beneficial to all utility parties, with a view to achieving the ultimate goal of promoting environmental sustainability.

Contribution 2: In chapter 3, this research contributes to the body of knowledge by formulating an appropriate theoretical framework for better investigating the user standpoint towards new initiatives of technology innovations development in utility management context. Such theoretical framework can be used to evaluate the suitability of the proposed integrated utility management platform (formulated in this study) from the user point view and to study the relationships that may exist between technology dimensions and user technology adoption and usage. According to the associated literature, evaluations of user technology acceptance and services adoption are typically underpinned using a theoretical framework as their basis, where the empirical results generally differ according to the field of study under investigation. It is widely recognised that, the development of new technology innovations is sector dependent, which implies that each technology innovation in the various sectors may reveal different factors that affect user technology adoption. In chapter 2 of this research, by considering the recent revolution of online services delivery strategies and the range of adoption and diffusion models in the literature, as well as finding one that suits the online utility management context, it was discovered that a theoretical framework to investigate the different aspects facing user technology acceptance and services adoption in a utility management context was absent. Thus, this research present a theoretical contribution to the body of knowledge, since, to the best of the author's knowledge, there is no theoretical model that has as yet been suggested as appropriate for this particular context. This model was presented in chapter 3 and discussed and analysed in chapters 6 and 7. Therefore, this research contributes theoretically and methodologically to the research topic, in addition to the related literature in the research areas of electronic services delivery, adoption and diffusion of innovations approaches.

Contribution 3: This research contributes to the knowledge by formulating an appropriate theoretical framework and associated integrated platform that shifts the focus to the importance of 'user-centric' innovative technology that match with user needs, as a direct determinant that would influence user intentions to use technology in a utility management context. The conclusion obtained from the practical lessons of data analysis in this research reveals that the full potential benefit of eService initiatives is unlikely to be accomplished without considering the user-demand and acceptance of such services. This point is clearly highlighted in the literature and is considered an important strategic decision in recent agendas of eService development that focus on efficient services delivery and better diffusion of the services among users. However, such important objectives are not yet realised in practice in a utility management services context and there is an emerging necessity to emphasise the development of strategies and the underlying platform that would overcome these challenges. In this direction, this research contribution to the research filed by highlights the need for considering the important role of the fit between users, technology and services providers as antecedent factors that have key influence on user technology acceptance. It argues that successful user adoption of technology services typically depends on the existence of a match between technologies with user-tasks needs. Based on that, this research developed a 'user-centric' conceptual platform and associated theoretical model that was empirically examined within the online utility management domain, and also can be recommended for further empirical examination in other domains. Such theoretical and practical contribution, can enable researchers in the field of research to have more insight into eService implementation as well as different themes and factors affecting user perceptions of technology-fit and benefits. Furthermore, it enables researchers to analyse and explore these themes and to have better understanding of the relationships with user technology acceptance thanks to the formulated conceptual model defined in this research.

Contribution 4: Given the nature of the research subject (i.e. the proposition of a user-centric and 'integrated virtual enterprise utility management' platform), the outcomes of this research provide a major contribution to the research field and literature in this domain, in particular, with regards to the literature related to pro-environmental sustainability. This is a worthy outcome since one of the aims of formulating the framework is the promotion of individual behavioural intentions towards sustainability. Raising awareness and knowledge, improving the role of technology innovation and its capacity to engage utility consumers in sustainability issues, will contribute towards this goal. In this respect, this thesis contribute in this area (Chapter 5, 6 and 7), by successfully incorporating the technology services with an end to promoting sustainable behaviour by concentrating on understanding different aspects from user perspectives including, users' service needs, their perception of technology-fit, benefits, ease of using the services, compatibility and integration of a sustainability related functionality that meets their tasks needs. Thereafter, the intention is to use the findings in the development of a user-centric electronic services delivery platform that facilitates user technology and achieve the goals of promoting sustainable behaviour. While the research results presented in this thesis are encouraging from a practical point view for the sustainability responsible organisations, from a theoretical perspective these results reconfirm that the proposed platform is expected to have a major influence on individual sustainable behaviour intentions. This was confirmed by a theoretical test of the key behavioural constructs including, attitudes, subjective norms and perceived behavioural control of the sustainability-related functionality services integrated in the proposed platform.

Contribution 5: Another practical contribution of this research was the proposition of a well-defined conceptual model for a user-centric and 'integrated virtual enterprise utility management' platform. Such a proposed framework can be used as a guide for sustainability responsible eService delivery organisations in a utility setting and other interested sustainable communities in order to create a successful collaborative platform that will contribute to the successful implementation of online services that would be more likely to be user accepted and serve the initiatives of promoting sustainability. This research forms a unique study that provides a integrative and comprehensive view addressing the issue of 'user-centric' eService delivery in utility management and makes efforts towards predicting individual's adoption and usage of future technology platforms. In addition, to the best of the researcher's knowledge, it is the first study conducted in the research domain and at a national level in Saudi Arabia. By formulating a well justified theoretical framework (within the context of this research) for studying emerging eService delivery paradigm, user technology acceptance, adoption, in addition to exploring the technology's role in influencing sustainable behaviour, this study provides a very relevant and significant contribution to the body of knowledge serving both researchers and practitioners in the relevant research areas of technology acceptance, adoption and sustainability behaviour change. Moreover, the research outcomes can enable the researchers to understand the challenges that might face eService diffusion in a prior stage of the implementation by predicting and managing users' expectations of eService benefits, acceptance, services adoption and usage

8.5 Recommendations and Directions for Future Research

This research has evaluated and highlighted noteworthy features of innovation appropriate to an integrated virtual enterprise utility management framework that would significantly influence the positive perception of utility users and their intentions to use these online services. From the research findings, it was found that such a framework could provide value-added services to all utility stakeholders and to the utility users specifically. It was evidently revealed that a future revolution in the service delivery paradigm in utilities should move towards an integrated virtual enterprise utility management platform that stresses the users' perspective as the main factor affecting their perceptions regards adopting the online services. The prominent features highlighted by the respondents are assumed to be crucial for the success of an integrated virtual enterprise environment platform. It can be concluded that, by adopting a user-centric service delivery strategy, the developers of internet-based utility services in the future, should devote significant attention to developing integrated standards of online service's provision for utility services across all utility agencies as well as a user-friendly, effortless, convenient and collaborative communication environment because these aspects can enhance value-added services as well as increase the number of users, thereby increasing the rate of user technology acceptance and online service adoption. The findings based on sample responses provide strong empirical evidence for the explanatory power of the integrated virtual enterprise utility management conceptual framework. The knowledge related to factors of perceived characteristics of the innovation as a major predictor of the utility user's intention to use the innovation can support the agencies responsible for online service delivery in utilities, with important future guidance for successful online services delivery and a greater focus on the utility users' demand-side.

The results of user perception survey of this study, show that utility users are mainly concerned about their interaction with multiple sources of online service providers. They need to interact with all online service providers at a single point, with the least possible effort required to perform their utility transactions online. For this purpose, these utility service providers should strive for the best integrated online service provision informed by users' needs. Future research should expand the scope of the study of the technology adoption from the service providers' point of view as well as to other utility stakeholders in order to cover all aspects of the recent paradigm of online service delivery that enables all utility parties to interact through a single point environment and achieve the purpose of the comprehensive management of national utility resources. In addition, more research should be undertaken to explore the integration and operability of service delivery in utilities across different administration boundaries between agencies to deliver a unified environment as the basis for future enterprise and a collaborative and integrated utility management platform (or 'one-stop' utility management model). For successful future online service delivery, the causal effects of the users' perceived characteristics of the innovation on users' satisfaction and services adoption should also be considered.

In this research, the emphasis was on conceptualising a user-centric integrative utility management platform in a virtual enterprise environment, where the ultimate goal was to provide a typical environment for promoting individual's sustainable behaviour through effectively supporting the awareness, knowledge, interventions and the activities of saving on resource consumption. In keeping with this direction of study, this research identifies and validates a list of sustainability-related functionalities that would be integrated within the proposed platform and have a positive impact on individual's behavioural intentions towards sustainability. An opportunity for future potential research is to extend these functionalities and implement them in a real environment in order to practically examine the actual effects on individual's overall sustainable behaviour decisions.

Lastly, our research has sole emphasis on the domain of eService delivery in utility management services. The generic features of the research platform that are conceptualised in the research model, increase the opportunities of it being applicable to other types of eService domains of e-society that are deemed to demand a similar collaborative and integrated shared platform.

8.6 Summary

To the best knowledge of the researcher, this research is the first study that was conducted in the domain of user-centric utility management service delivery platforms in a virtual enterprise environment and particularly, at the national level of Saudi Arabia. Thus, it can be concluded that this study contributes to the body of knowledge in multi-disciplinary research areas relevant to the research topic and in particular, to the information system research fields and pro-environmental sustainability research area.

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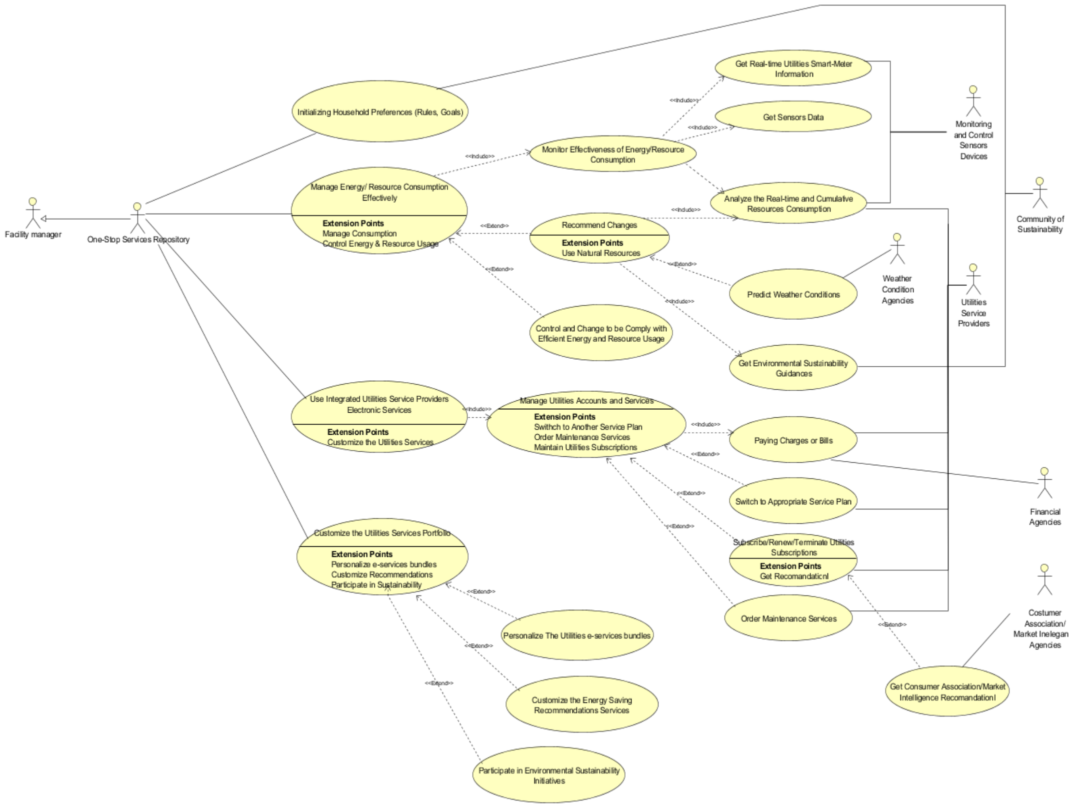
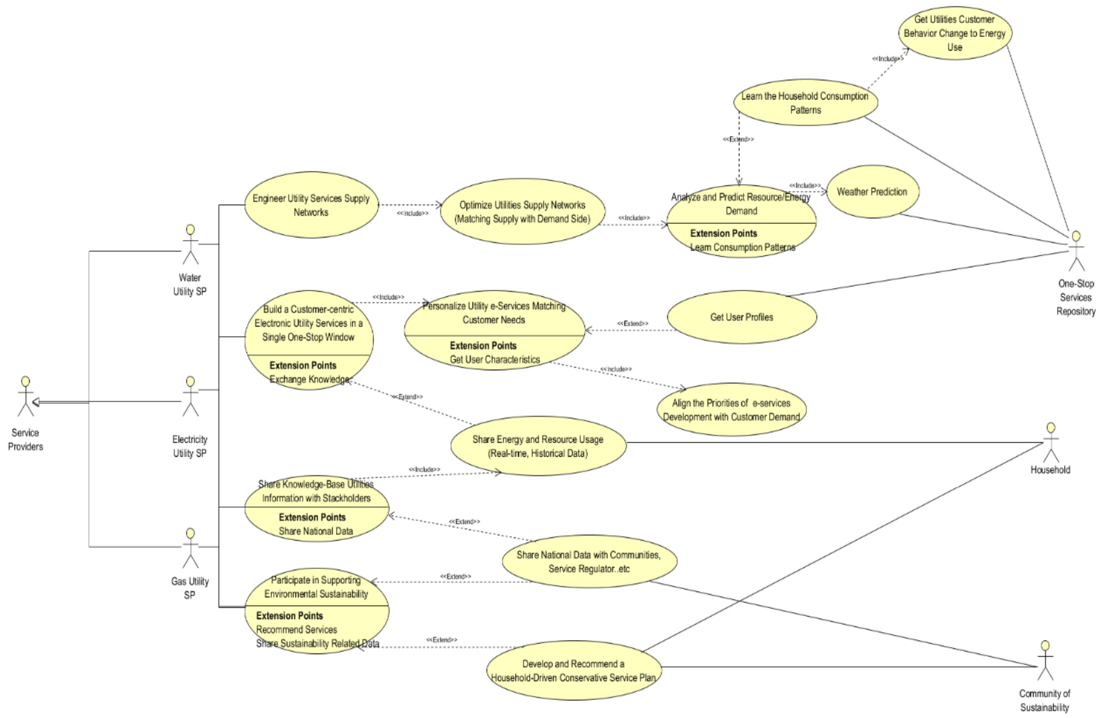
Appendix A: Example of use-case diagrams used for prototype system analysis and design (Integrated Virtual Entrprise Utility Management' platform)



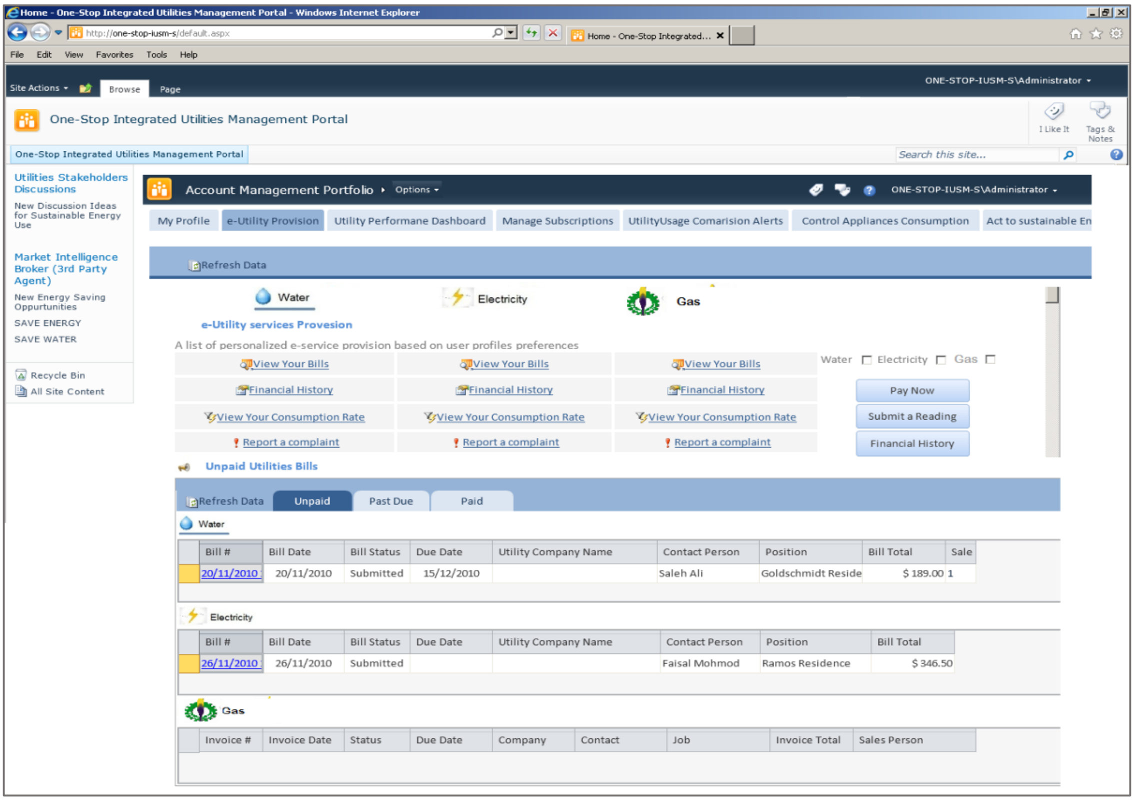
Example of use-case diagrams (household perspectives)



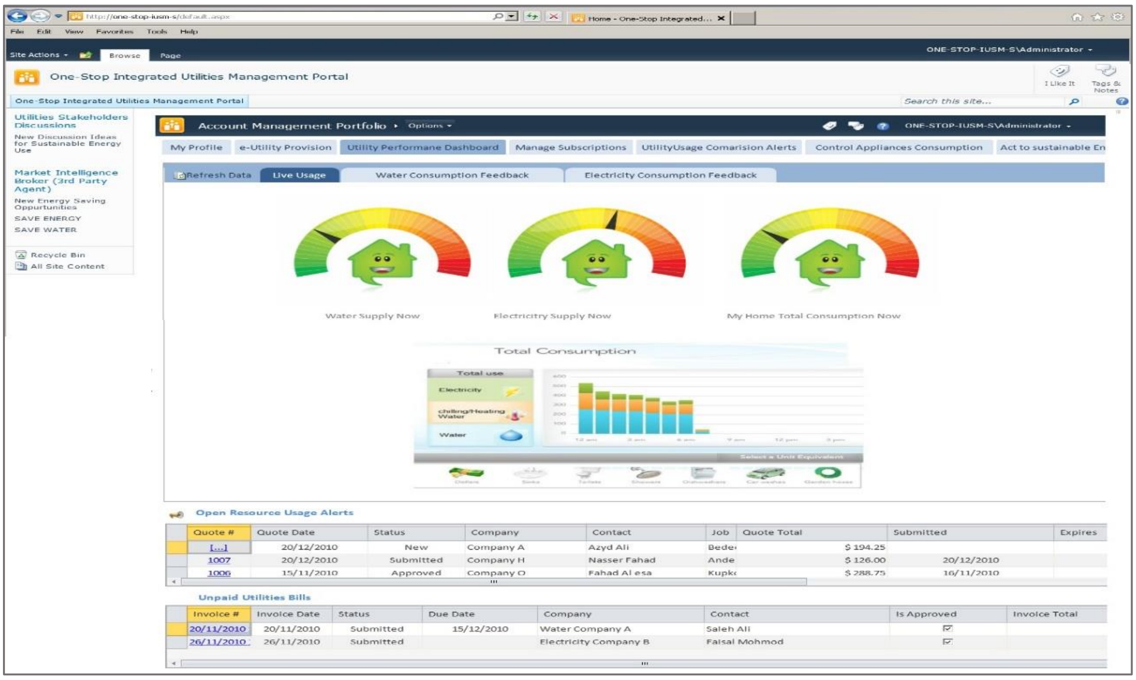
Example of use-case diagrams (Service providers perspectives)

Appendix B: Sample screenshots of the prototype ‘one-stop’ Integrated Utility Management’ platform

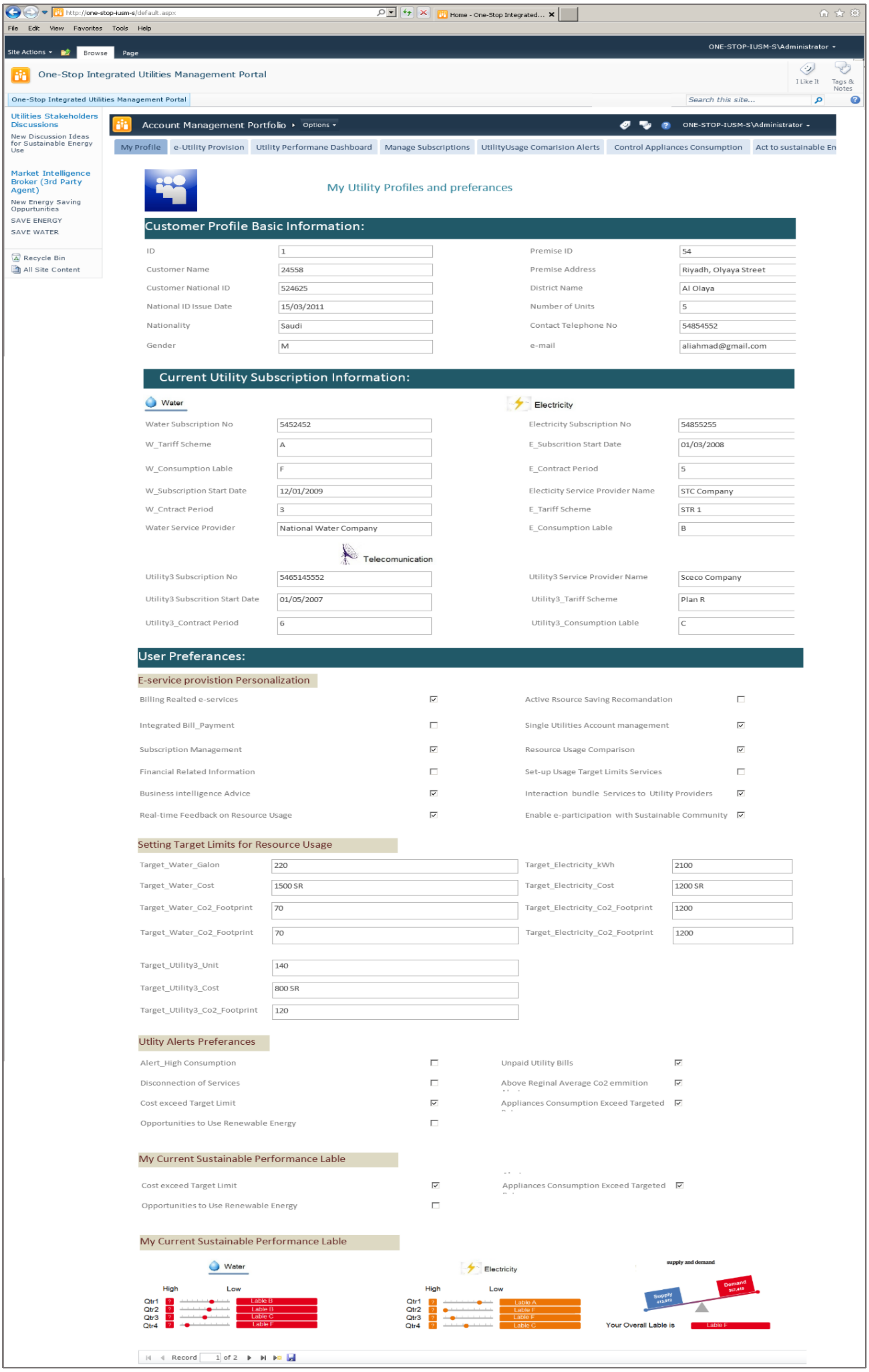
Screenshot of user authentication window



Screenshot of main user interface of one-stop prototype utility management platform



Screenshot Integrated utility performance dashboard (consumption feedback, alerts, monotoring and control)



User profiling (basic information, preferences, target setting, sustainability performance labelling etc.)

Appendix C: Questionnaire Survey

دراسة علمية لإستطلاع تصور عملاء قطاع خدمات المرافق عن الخدمات الإليكترونية والتوجه نحو الإدارة الموحدة لخدمات المرافق وتكامل الخدمات الإليكترونية

أخي العزيز / أختي العزيزة ،،،

أود في البداية أن اقدم لكم الشكر لأخذ جزء من وقتكم لملء هذا الاستبيان.

إن هذا البحث يتضمن دراسة استطلاعية للراي لفهم التصور الخاص بكم عن عدد من الجوانب المتصلة بالخدمات الاليكترونية المتاحة حاليا من مقدمي الخدمات العامة للمرافق (الكهرباء والمياه،...وغيرها) والتي تقدم خدماتها للمساعدة في إدارة المرافق الخاصة بكم على الانترنت .ونود ان نشكركم على اعطائنا الفرصة لمعرفة وجهة نظركم عن ما هو متوفر حاليا أو حتى في حالة عدم استخدامكم لتلك الخدمات الاليكترونية من قبل، حيث أن التصور الخاص بكم في كلا الاحوال يعد ضروري أيضاً للمساعدة في تحقيق أهداف البحث . هذا الاستبيان هو جزء من البحث لنيل درجة الدكتوراه ويعد تعاونكم معنا في ملء هذا الاستبيان محل تقدير وامتنان من قبلنا لاهمية مشاركتم ومساهمتكم معنا في اكمال متطلبات البحث .إذا كان لديك أي أسئلة، أو تحتاج إلى مزيد من التوضيح من فضلك لا تتردد في الاتصال بي على بريدي الإلكتروني على العنوان التالي: utilitypassport@gmail.com

شكرا جزيلا لكم مشاركتكم معنا

مع أطيب تحياتي،،،

باحث مرشح لنيل درجة الدكتوراه في الهندسة – جامعة كارديف – المملكة المتحدة

أولاً: البيانات الإجتماعية :

1) **الجنس :**

□ ذكر　　□ أنثى

2) **العمر :**

□ 15 – 0　　□ 19 -16　　□ 23 – 20　　□ 27 - 24

□ 31 - 28　　□ 35 – 32　　□ 39 -36　　□ 50 – 40　　□ +50

3) **الحالة الاجتماعية :**

□ أعزب　　□ متزوج　　□ مطلق　　□ أخرى

4) **دخل الأسرة الشهري (بالريال السعودي) :**

□ 3000 – 0　　□ 5000 -3001　　□ 7500 – 5001

□ 10000 - 7501　　□ 12500 - 10001　　□ 15000 – 12501

□ +15001

5) **عدد أفراد العائلة :**

أطفال	بالغين	العمر اكبر من 50 سنه
□ 2 – 1	□ 1 – 2	□ 1 – 2
□ 3 – 4	□ 4 – 3	□ 4 - 3
□ +4	□ 6 - 5	□ +4
□ +6	□ + 6	

6) **المستوى التعليمي :**

- ☐ إبتدائي ☐ متوسط ☐ ثانوي
- ☐ دبلوم او ما يعادلها ☐ درجة البكالوريوس أو ما يعادلها ☐ الماجستير او الدكتوراه أو ما يعادلها
- ☐ درجه متخصصة غير علمية ☐ أخرى

7) **العمل أو الوظيفة :**

- ☐ موظف في القطاع الحكومي ☐ خبير أو متخصص ☐ مدير تنفيذي
- ☐ موظف في القطاع الخاص ☐ طالب ☐ اكاديمي
- ☐ موظف على حسابي الخاص ☐ فني ☐ متقاعد
- ☐ لا اعمل ☐ غير ذلك...

8) **منذ متى وانت تقيم في هذا العقار(منزلكم)؟**

- ☐ أقل من 3 أشهر ☐ من 3 الى 6 أشهر ☐ 6 أشهر الى سنة ☐ أكثر من سنه - 2 سنه
- ☐ أكثر من 2 - 3 سنوات ☐ أكثر من 3 سنوات ☐ أخرى ....

ثانياً: توجهاتك في التعامل مع الإنترنت و الخبرات السابقة :

9) **هل تتوفر لديك خاصية الإتصال بالانترنت بإستمرار؟**

- ☐ نعم ☐ لا

10) **كم عدد مرات استخدامك للإنترنت؟**

- ☐ مستخدم بإنتظام ☐ عدة مرات يومياً ☐ مره واحدة يوميا ☐ عدة مرات في الاسبوع
- ☐ عدة مرات بالشهر ☐ مرة واحدة شهرياً ☐ أبداً

11) **أنا استخدم الانترنت لأغراض ...** (الرجاء إختيار كل ما هو مناسب)

	استخدام مستمر	**مره يومياً**	**مره اسبوعيا**	**مره شهرياً**	**غير مستخدم على الاطلاق**
المزيد من المعرفة ...	☐	☐	☐	☐	☐
لتصفح المواقع المختلفة ...	☐	☐	☐	☐	☐
لتحميل وارسال الملفات ...	☐	☐	☐	☐	☐
أعمال تجارية ...	☐	☐	☐	☐	☐
البريد الاليكتروني ...	☐	☐	☐	☐	☐
الدردشة الاليكترونية ...	☐	☐	☐	☐	☐
التسوق الإليكتروني ...	☐	☐	☐	☐	☐
التعاملات البنكية (e-banking) ...	☐	☐	☐	☐	☐
البحث العام عن المعلومات ...	☐	☐	☐	☐	☐

☐ أخرى ... أذكرها ....

12) ما تقييمك العام لمدى تفاعلك مع مواقع تقديم الخدمات الإليكترونية ؟
(مثال الخدمات الإليكترونية e-booking, e-banking, e-gov وغيرها)

	موافق بشده	موافق	محايد	غير موافق	غير موافق إطلاقا
	☐	☐	☐	☐	☐
لدي شعور بالراحة لاستخدام الخدمات الإليكترونية على الانترنت	☐	☐	☐	☐	☐
أفضل استخدام الخدمات الاليكترونية على زياره فروع مزودي خدمات المرافق والتواصل معهم وجها لوجه	☐	☐	☐	☐	☐
أنا من أوائل من يعتاد على التعامل مع الخدمات الاليكترونية	☐	☐	☐	☐	☐
أنا من أوائل من يعتاد على التعامل مع الخدمات الاليكترونية	☐	☐	☐	☐	☐
اثمن استخدام الخدمات الإليكترونية ولدي شعور ايجابي تجاهها	☐	☐	☐	☐	☐

13) أنا معتاد على استخدام الخدمات الاليكترونية في إدارة خدمات مرافق منزلي ؟
مثال الخدمات الاليكترونية في خدمات مرافق: الكهرباء، الماء، الإتصالات ...الخ

☐ نعم ☐ لا

ثالثاً: تصور وأراء العملاء حول الخدمات الإليكترونية المقدمة حالياً من قبل شركات مزودي خدمات المرافق على الإنترنت :

استناداً على خبرتك السابقة في التعامل مع الخدمات الإليكترونية المقدمة من شركات خدمات المرافق
(مثل: شركة الكهرباء، المياه، الإتصالات ...الخ)

14) هل لديك علم بالخدمات الإليكترونية التي تقدمها شركات مزودي خدمات المرافق والتي تتيح لكم إمكانية التعامل خدمات مرافق عقاركم اليكترونياً ؟ (مثل: شركة الكهرباء، المياه، الإتصالات ...الخ)

☐ نعم ☐ لا

15) خلال الـ 12 شهر الماضية، هل سبق ان استخدمت اي من الخدمات الإليكترونية المتوفره غلى موقع شركات خدمات المرافق على الأنترنت؟ (مثل: شركة الكهرباء، المياه، الإتصالات ...الخ)

☐ نعم ☐ لا

16) الرجاء تحديد المدى الذي تستخدم فيه الخدمات الإليكترونية للقيام بأعمال ...

	دائماً	غالباً	بعض الأحيان	نادراً	أبداً
دفع فواتير الخدمات اليكترونياً	☐	☐	☐	☐	☐
(التوفير في استهلاك الخدمات (مياه، كهرباء ... الخ	☐	☐	☐	☐	☐
تقديم الشكاوي والإقتراحات اليكترونياً	☐	☐	☐	☐	☐
الإطلاع على تفاصيل بيانات خدمات المرافق	☐	☐	☐	☐	☐
طلب صيانه للخدمة اليكترونياً	☐	☐	☐	☐	☐
التواصل مع شركات خدمات المرافق	☐	☐	☐	☐	☐
الإطلاع على السجلات السابقة للإستهلاك	☐	☐	☐	☐	☐
التحكم وتغيير إشتراكاتي بالخدمة اليكترونياً	☐	☐	☐	☐	☐
تعديل خيارات إشتراكاتي بالخدمات وباقات التعرفة	☐	☐	☐	☐	☐

17) الرجاء حدد الأسباب والدوافع الرئيسية التي تحفزكم على استخدام الخدمات الإليكترونية المذكورة أعلاه في إدارة خدمات مرافق منزلكم اليكترونياً ؟ (الرجاء إختيار كل ما هو مناسب على إفتراض أن تلك الخدمات الإلكترونية متاحة لكم حاليا)

☐ جاذبية موقع الشركة على الإنترنت ☐ ملائمة الخدمات الإليكترونية ☐ الدعاية الاعلامية والعروض الترويجية للخدمات

☐ الحوافز التشجيعية والمكافات ☐ الرغبة في طلب الخدمة اليكترونياً ☐ تقليل الجهد المبذول للحصول على الخدمات

☐ سهولة طلب الخدمة ☐ التوفير في التكاليف المالية ☐ الرغبة في تقليل الاستهلاك للموارد لأسباب بيئية

☐ الحصول على معلومات فورية عن خيارات الخدمة ☐ أخرى ....

18) هل تشعر بالإرتياح لطريقة الوضع الحالي في إختلاف طريقة تسديد فواتير الخدمات لمنزلكم (مياه،كهرباء، إتصالات) ؟

(لكل شركة خدمات المرافق مياه، كهرباء، اتصالات طريقة مختلفة في عرض وتسديد الفواتير)

☐ نعم ☐ لا

19) هل لديك ثقة في الخدمات الإليكترونية التي يقدمها لكم شركات خدمات المرافق على الإنترنت؟

☐ نعم ☐ لا

في حالة الإجابة بـ لا، أذكر السبب ....

20) هل تشعر بأن الخدمات الإليكترونية الحالية المتاحة من قبل شركات خدمات المرافق هي ما تبحث عنه؟

☐ نعم ☐ لا

في حالة الإجابة بـ لا، أذكر السبب ....

رابعاً : تصور العملاء عن مفهوم الإستخدام الأمثل لموارد الخدمات (مياه، كهرباء، الطاقة ...الخ) :

21) هل لديك اهتمام بالحصول على معلومات مفصلة عن إستخدامك لموارد الخدمات في منزلكم (مياه، كهرباء، طاقة ...الخ)؟

(مثال :معلومات تفصيلية للفواتير وبيانات الإستهلاك للموارد)

☐ نعم ☐ لا

22) هل لديك الإعتقاد بأن استهلاك المياه في منزلكم سيؤثر على فاتورة الكهرباء؟

☐ نعم ☐ لا

23) هل لديك شعور بالقلق تجاه إمكانية نضوب موارد للخدمات؟

(موارد المياه، الكهرباء والطاقة...الخ)

☐ نعم ☐ لا

24) هل يعد شعوركم تجاة المحافظة على موارد الخدمات، احد العوامل المحفزه لكم للتوجه نحوالإنخراط في إستخدام الخدمات الإليكترونية المقدمة من شركات خدمات المرافق؟

☐ نعم ☐ لا

25) هل لديك الإعتقاد بأن نمط حياتك المعيشية لها تأثير على كمية استهلاكك لموارد خدمات المرافق؟

(موارد المياه، الكهرباء والطاقة...الخ)

☐ نعم ☐ لا

خامسا : تصور العملاء عن التوجة في المستقبل نحو المزيد من تجميع الخدمات الإليكترونية وتمكين العميل من الإدارة الموحدة لخدمات المرافق اليكترونياً :

26) ما هو التصور الخاص بكم تجاه الخدمات الإليكترونية الموجودة حالياً على مواقع شركات تقديم خدمات المرافق (مياه، كهرباء، طاقة ... الخ) على الإنترنت، وتوقعاتكم من الإحتياجات المستقبلية؟

	موافق بشده	موافق	محايد	غير موافق	غير موافق إطلاقا
أشعر أن هناك نقص في تكامل الخدمات الإليكترونية بين مقدمي خدمات المرافق على الانترنت؟	☐	☐	☐	☐	☐
أعتقد أن هناك حاجة للمزيد من الاستثمار في مجال تجميع الخدمات الإليكترونية لجميع خدمات المرافق (مياه، كهرباء، ...الخ) والدخول لها بشكل موحد، من أجل تعزيز الفائدة وتشجيع العملاء على إستخدامها؟	☐	☐	☐	☐	☐
أشعر بالرضا العام عن اخر تجربة للخدمات الإليكترونية لإدارة خدمات مرافق منزلي اليكترونياً؟	☐	☐	☐	☐	☐
أنا مهتم في الحصول على تصميم واجهة استخدام خاصة بي كنافذه لإستخدام الخدمات الإليكترونية تمكني من إدارة خدمات مرافق منزلي عبر الإنترنت؟	☐	☐	☐	☐	☐
أن تجميع الخدمات الإليكترونية لخدمات مرافق منزلي معاً في موقع اليكتروني واحد، سوف يجعل من الافضل تقبل تلك الخدمات والتعود على استخدامها؟	☐	☐	☐	☐	☐
أن منح العميل إمكانية وضع حد أعلى لإستهلاك موارد الخدمات (مياه، كهرباء، طاقة ...الخ) للحد من زيادة استهلاك موارد خدمات المرافق يعد فكرة تستحق التطبيق؟	☐	☐	☐	☐	☐

27) لنفترض عن وجود خدمات اليكترونية موحدة عبر الإنترنت يتم من خلالها تقديم جميع الخدمات الإليكترونية اللازمة لإدارة خدمات المرافق الخاصة بعقاركم (مياه، كهرباء، إتصالات ...الخ) في مكان واحد وبطريقة وصول موحدة ومتكاملة، هل تفضل ان تشمل على:

☐ الإحتفاظ التلقائي بمعلوماتكم واسترجاعها لكم عند الحاجة
☐ العرض المباشر لكم عن الاستهلاك من الخدمات
☐ مجموعة خدمات اليكترونية في مكان واحد ومتكاملة
☐ طريقة موحدة لإجراءات دفع مستحقات الخدمات
☐ خدمات عرض الاستهلاك مع مقارنة بالمجاورين
☐ خاصية تمكينكم من تحديد سقف اعلى للإستهلاك
☐ عرض تحليلي شامل عن الإستهلاك
☐ إتاحة التواصل المباشر مع مزودي شركات خدمات المرافق
☐ تسهيل الإنظمام الى المشاركة في اهداف منظمات البيئة المستدامة
☐ إمكانية الإدارة الموحدة لجميع اشتراكاتكم مع شركات خدمات المرافق
☐ تقديم المشوره الفورية لكم عن الإستهلاك والعروض الترويجية
☐ أخرى ....

28) لتغيير نمط سلوكي في استهلاك موارد خدمات المرافق (مياه،كهرباء، إتصالات ...الخ)، فانني اتاثر بـ......

(الرجاء إختيار تقييمك المناسب للعبارات التالية، حتى لو كنت غير مستخدم حالياً للخدمات الإليكترونية، حيث أن هذه الأسئلة هي لأغراض معرفة نظرتكم الحالية وتطلعاتكم عن الخدمات الإليكترونية المخصصة لإدارة خدمات المرافق لعقاركم عبر الإنترنت)

	موافق بشده	موافق	محايد	غير موافق	غير موافق إطلاقا
...نمط سلوك المجاورين في إستهلاك موارد خدمات المرافق (مياه، كهرباء، إتصالات)	☐	☐	☐	☐	☐
...المقارنة مع المناطق المجاورة في إستهلاك موارد خدمات المرافق لها تأثير بالغ على تغيير نمط سلوكي في الإستهلاك	☐	☐	☐	☐	☐
...المشورة والتوصيات المقدمة من مزودي خدمات المرافق وهيئة تنظيم الخدمة (مياه، كهرباء، إتصالات)	☐	☐	☐	☐	☐

سادساً: تقييم جاهزية تقبل العميل نحو النموذج المبتكر للخدمات الإليكترونية الموحدة للإدارة المتكاملة لخدمات المرافق اليكترونياً

في هذا الجزء من الاستبيان، نرغب فهم المزيد عن تصوركم الخاص نحو النموذج المبتكر للبوابة الإليكترونية الموحدة للإدارة المتكاملة لخدمات مرافق العقار (خدمات اليكترونية موحدة للمياه، الكهرباء، الإتصالات ...الخ .(الرجاء ذكر تقييمك لتوقعاتكم عن هذا النموذج المبتكر بإستخدام المقياس الموضوعي في العبارات التالية:

29) هل تؤيد فكرة توحيد وتكامل الخدمات الإليكترونية المقدمة من شركات خدمات مرافق عقاركم في إطار بوابة اليكترونية موحدة تمكنكم من الإدارة المتكاملة لجميع موارد خدمات المرافق الخاصة بكم من مكان واحد؟

من وجهة نظركم، هل النموذج المبتكر يعد : (الرجاء تحديد الخيار المناسب)

	1	2	3	4	5	
فكرة غير جيدة	☐	☐	☐	☐	☐	فكرة جيدة
من الحكمة تطبيقها	☐	☐	☐	☐	☐	غير قابلة للتطبيق
ابتكار مفيد	☐	☐	☐	☐	☐	غير مفيد

30) النسبة لي، أرى أن استخدام إبتكار توحيد وتكامل الخدمات الإليكترونية في محفظة اليكترونية موحدة بغرض التمكن من إدارة موارد خدمات مرافق منزلي مع جميع شركات خدمات المرافق (مياه، كهرباء، إتصالات) سوف يكون .....

	موافق	محايد	غير موافق
...تجربة إيجابية لي	☐	☐	☐
...فرصة اكبر للإستفادة من الخدمات على الانترنت	☐	☐	☐
...مفيد في الإستخدام وممتع أيضاً	☐	☐	☐
...ابتكار حكيم	☐	☐	☐
...مخاطرة عالية	☐	☐	☐

31) إن إبتكار في توحيد الخدمات الإليكترونية لخدمات المرافق (مياه، كهرباء، إتصالات) في محفظة اليكترونية موحدة لإدارة خدمات مرافق العقار سيكون مفيد لي في ...

☐ معرفة أكثر دقة للإستهلاك الفعلي لدي من موارد الخدمات ☐ زيادة الوعي الخاص بي عن باستخدام الموارد والطاقة

☐ تحقيق اهدافي من وضع حد معين لتخفيض الإستهلاك ☐ سهولة التواصل مع جميع شركات مزودي خدمات المرافق

☐ أخرى ....

32) لنفرض أن إبتكار توحيد الخدمات الإليكترونية لخدمات المرافق (مياه، كهرباء، إتصالات) ضمن بوابة اليكترونية موحدة للإدارة خدمات مرافق العقار متاحة لكم حالياً، ما مدى احتمال استعدادكم لي:

	جدير بالإهتمام	مهتم	مهتم نوعاً ما	غير مهتم	غير مهتم اطلاقاً
...محاولة تجربة أستخدامة؟	☐	☐	☐	☐	☐
...أن كون مستخدم له بإنتظام؟	☐	☐	☐	☐	☐
...الإستفادة من توفر المعلومات في تغييرسلوكي الخاص بالاستهلاك (عادات الإستهلاك)؟	☐	☐	☐	☐	☐
...أن أتقبل فكرة دخول طرف أخر كوسيط بيني وبين مزودي خدمات المرافق (مياه كهرباء، إتصالات) لتقديم خدمات أحترافية إضافية للمشورة وتسهيل مهام كفاءة الإدارة الخدمات؟	☐	☐	☐	☐	☐
...قبول مشاركة الفائدة الناتجة عن تحقيق خفض في الإستهلاك مع طرف وسيط يعمل على مساعدتكم وتقديم المشورة وخدمات التكامل في الخدمات الإليكترونية مع جميع مزودي خدمات المرافق من الشركات؟	☐	☐	☐	☐	☐
...استخدام البدائل من الموارد الطبيعية أو الطاقة المتجددة (إن وجدت) لأغراض خفض إستهلاك موارد الخدمات؟	☐	☐	☐	☐	☐
...التواصل اليكترونياً مع إطراف خدمات المرافق لأغراض تحقيق الحفاظ على المصادر الطبيعية للخدمات؟	☐	☐	☐	☐	☐
...الرجاء تحديد مستوى اهتمامك العام؟	☐	☐	☐	☐	☐

33) الرجاء أذكر بالتفاصيل، ما هي دواعي أهتماماتك في مثل هذا الإبتكار؟

(الرجاء إختيار كل ما هو مناسب)

- ☐ الحصول على محفظة من الخدمات مفصلة خصيصاً لإحتياجاتكم
- ☐ تحقيق اهدافك في خفض إستهلاك الموارد
- ☐ دفع المستحقات بطريقة وموحدة لجميع الخدمات
- ☐ تقيل الجهد في إدارة خدمات المرافق
- ☐ إدارة الإشتراكات في خدمات المرافق من مكان وحد
- ☐ تقليل التكلفة المالية
- ☐ القدرة على التحكم والسيطرة على استهلاك الخدمات
- ☐ تقليل عدد فواتير الخدمات
- ☐ معلومات فورية عن الإستهلاك (الحالي، الماضي)
- ☐ أخرى ....

34) ما هي قنوات تقديم الخدمة المناسبة لكم؟

- ☐ موقع بوابة للخدمات الإليكترونية على الإنترنت
- ☐ الجوال والأجهزة الذكية
- ☐ نظام الرد الآلي IVR
- ☐ رسائل التحذير حسب الأحداث
- ☐ أخرى ....

هل ترغب في إشعاركم بنتائج البحث الحالي والمشاركة مستقبلاً في تعبئة الإستبان القادم للجزء الأخر من الدراسة البحثية؟

☐ نعم، أنا لدي إستعداد للمشاركة ☐ لا، شكرا

البريد الإليكتروني: ....@.......................................

هل لديك إضافات أو تعليقات، من فضلك أذكرها:

....

....

....

....

شكرا لوقتكم معنا ،،،