# Towards the Innovation of an Integrated 'One-Stop-Shop' Utility Management: Exploring Customer' Technology Acceptance

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## Abstract

Internet online service delivery has transformed the way people interact with technology, resulting in an exponential growth in the number of online users. Consumer characteristics and ways of providing services online have had a dramatic change on user acceptance and perceived value of technological innovation. Therefore, user perception is a vital issue in investigating user intentions in adopting online services. The scope of this paper is to examine the perceptions of adopters and non-adopters of online utility management, in terms of their experience towards existing service delivery approaches and their expectations of future innovations. User perceptions contribute to defining an initial roadmap for exploring the evolution of 'utilities service management' on the Internet while informing approaches to online service delivery. This highlights the general need for a value-added and integrated utilities service management solution as well as the specific demand of internet users for the integrated online delivery of utility services to serve their particular interests.

This paper discusses several traditional approaches in related fields of electronic service delivery and demonstrates how the current situation demands a shift towards an integrated utilities service management solution that factors in the interests of all stakeholders.

**Keywords:** household, integrated utilities service management, resource/energy consumption, personalization, knowledge-based information provisioning, profiling.

# 1 Introduction

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

In the context of online utilities, many utility agencies have worked hard to develop electronic services and to 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 and designed from the service provider's point of view. In this situation, the service provider takes the initiative in making electronic services provision available online and easily accessible to its customers, regardless of any difference in customer preferences or demands. 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.

Some organizations that have similar roles to utility providers have recently updated their service delivery agenda to focus on user needs as a crucial success factor of service adoption. They do this by paying considerable attention to online service acceptance from the users by meeting their expectations. This change in service delivery approach is essentially emerging from the need to improve various aspects of service diffusion and user adoption. The noticed lack of user service acceptance and

low adoption found in previous studies indicate a need to includeusers' 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 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 can incorporate the utilities 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, optimization 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 services infrastructure as a medium for interaction between utilities parties, including service provider regulators, users, government agencies, and sustainable communities. Building such comprehensive integrated services delivery approach is expected to have a role in facilitating the superior goals gained in such a practice in order to promote sustainability and environmental welfare by providing a means for all parties to cooperate in use utility resources efficiently.

In its present state, following trend in technology innovation is essential , rather than being an option (Johnson et al., 2000, Fitzsimmons and Fitzsimmons, 2008). Every year new services are initiated with a high failure rate, due to a number of different reasons (Brown and Eisenhardt, 1995, Stevens and Burley, 2003). In some previous initiatives, the reasons for failure stemmed from the difference between perception and service 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 agenda may not fit the customer expectations or be consistent with their needs. It might indeed make users more indifferent to the acceptance, or convenience, of the electronic services provided by utility organizations, which often result 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 (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 difference in perceptions is traditionally due to the dominance of the service provider perspective towards service innovation. However, from another comprehensive point of view, the main measures of the success of online services delivery for utility management are the experience of users and their actual use of these services, as determined by whether they meet their expectations and are conducive to providing online service satisfaction.

This paper contributes to this debate 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 for a framework of integrated ‘one-stop-shop’ utility management. 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 utilities stakeholders via better electronic services within the a shred environment. This paper takes a new look at electronic utility service management and proposes a roadmap that is designed to be effective

from different perspectives but with a particular focus on the users' perspective so that they will be able to access integrated utility services through a 'one-stop-shop' website, even if these services are actually provided by different authorities or service providers.

We study the extent to which users actually perceive the novelties built into service dimensions, and the manner in which perceptions of 'one-stop-shop' innovation influence their usage intention. We will proceed with a review of the literature surrounding the development of a conceptual framework of integrated 'one-stop-shop' online utility services followed by a definition of the theoretical model for exploring/predicting user willingness to adopt the innovation through a formulation of substantive hypotheses, a description of the data analysis results of the survey study undertaken to substantiate the hypotheses and finally a discussion of research findings.

The rest of this paper is organised as follows. Section 2 describes the current state of existing electronic services on the utility service providers' websites and in the utility sector in general. Section 3 traces the evolution of public electronic service delivery strategies and compares user-oriented services with approaches designed to benefit the service provider. It also discusses the one-stop-shop service delivery paradigm as an interesting trend in user-centric service delivery. In addition, it highlights research theories conducted previously that explore/predict user acceptance of technology innovation. In the last part of this section, the apocopate theories are used to underpin the theoretical framework of this study by enabling a prediction of utility user intention to use an innovation of integrated 'one-stop-shop' utility services. Section 4 discusses the limitations of existing electronic utilities service management, especially their failure to provide value-added services to all stakeholders, and sets out the motivation for designing the integrated utilities management model. This is followed by a discussion of the future integrated 'one-stop-shop' online utilities

management framework with a detailed discussion on the desired component and expected beneficial outcomes of such an environment for the sake of utility management purposes, and a roadmap to overcoming the challenges and limitations of the current situation. Section 5 highlights the research methodology followed in the study and its design. Section 6 discusses the data analysis results and findings. Finally, Section 7 presents the main conclusions and directions for future research.

## 2 Background and conceptual model

This section reviews related work and elaborates on (a) online service delivery approaches, (b) the concepts of a one-stop service delivery approach, and (c) related models of user perception to technology innovations.

### 2.1 Revolution in online service delivery approach

Online service delivery has been described as an important attribute for online business (Lohse and Spiller, 1998). The absence of face-to-face interaction with the online user leads organizations to realise that traditional ways of service delivery are inadequate and that the provision of services over electronic networks, referred to as 'online services', is required (Rust and Kannan, 2003).

In the emerging intelligent approach for online service delivery, the focus has shifted from the traditional provision of online services to the customer to a new integrated services approach by which organizations can increase the value of their services to the customer. For example, in e-government there is an emerging need to adopt a new approach for delivering online services to public users, and their strategy has been adapted accordingly (Nations, 2010). Another similar application of this approach is the European Commission online service delivery roadmap, which highlights the need to meet user expectations by applying an intelligent electronic

services delivery approach, considering the user demand-side in future implementation strategy.

Other studies have shifted the focus of their service delivery strategies from the organizational supply-side point of view to user-centric service provision, which scholars consider an important shift (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). Yet other studies go even further in considering the user demand perspective and consider it as a critical determinant for the success of the online service delivery approach, deeming it useful for the sake of promoting user technology acceptance and innovation adoption (Christopher G, 2004, Graafland-Essers, 2003, Hinnant and O'Looney, 2003, Wendy, 2003, Tung and Rieck, 2005).

Several applications of the online services provision of user needs are implemented in private and public organizations (e.g. e-government, e-commerce, e-heath etc.). The service delivery approach that is adopted depends mainly on the organization strategies, which affects the levels of online presence, as well as how customers can be attracted and their needs satisfied. Such applications offer online services that meet customer needs which are interactive, customized, and more responsive, this in turn assists the businesses to create more valuable customer relationships and achieve a better competitive advantage (Chidambaram, 2001).

A lot of research has been carried out to assess the perspectives on electronic services. This has come about through the increased need to promote the quality, adaptation and usability features of online services, which has created a growing interest on the behalf of researchers to assess and evaluate the methodology of developing the online electronic services applications (Wade and Nevo, 2006, Schubert and Dettling, 2002). A major part of the observation and measurement has included

using different criteria to evaluate the level of customer satisfaction with the fulfilment of online services according to customer needs (Schubert and Dettling, 2002, Awan and Singh, 2006). This was created to acquire feedback from the customers and measure their level of satisfaction regards the services being offered (Lu and Lu, 2004), which is considered as a part of the cost-benefit analysis to the agencies; for instance, to justify the benefits businesses were expected to get the development of online service applications (Drinjak et al., 2012) or e-business investment evaluation of online services (Giaglis et al., 1999).

Similar to the evaluation of customer satisfaction by considering the user demand perspective, the provision of electronic services delivered from the utility service does not meet user expectations non match their needs. Indeed, there is a considerable gap between the supply of public online services and the demands of users. Recent studies highlight a critical success factor for electronic service delivery methodologies, which mainly relies on the importance of considering the customer perspective in designing the online service delivery strategy. Another previous study (Lee-Kelley and Kolsaker, 2004) has illustrated that the success of electronic services delivery "requires the citizens' 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 success of public online service delivery strategies is based on its ability to be more focused in measuring the benefits of electronic services to the users. In the recent intelligent electronic service delivery agendas, the user perception and intention to accept these services is considered to be essential for building a successful online services delivery model.

## 2.2 One-stop service delivery approach – The concepts

An earlier study of the 'one-stop-shop' online service delivery approach (Maria A, 2002) describes 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 is able to access these services in a well-structured and understandable manner meeting his/her perspectives and needs"(Wimmer, 2002, p.149).

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

In line with the concept of single window applications that integrate application technology for the benefit of households, this study highlights a demand for a cloud-based integrated utility service management model that considers the perspectives of all of the different utility service stakeholders and the perspectives of their various needs. The aim is to help users to achieve their goals in managing their overall utility service portfolio via the Internet using a single point of access to utilities services in their property via a comprehensive environment delivered by a value added service for all

parties. By considering the user perspective, this framework lends them the capacity for overall control of resource use and energy management according to a set of user-defined targets and rules. Thus, householders will have worthwhile tools for the effective and efficient management of utility resources and can participate in promoting environmental sustainability. Furthermore, an integrated 'one-stop-shop' utility management model would facilitate the engagement of ordinary people in environmental sustainability initiatives and encourage them to be more active in relation to energy saving and participating in the efficient management of their resource consumption.

## 2.3 Related models of user perception to technology innovations

An innovation is defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 11). The people who may adopt an idea will determine the relative 'novelty' of an idea in this case. According to Van de Ven (1986), although some people may consider an idea as a replica of something that exists elsewhere, it will still be perceived as new in so far as the group of people involved consider it as new. This explains the relation of newness of an idea to the innovations. Moreover, Rogers (1995) has proposed that the attitudes of the users towards an innovation will be shaped by the manner in which the potential adopters are considering an innovation.

Different models have been employed in recent studies to try to describe or predict the technological innovation acceptance by users. These studies investigate the intention of the users to accept technological innovations taking place using different theoretical models, including: the theory of technology acceptance model (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 diffusion theory (IDT).

TAM, presented by (Davis, 1985), has been used in different information system disciplines to predict and describe the user' behaviour to technology innovation and their intention for using it (Shih, 2004, Yu et al., 2005). It has since been used in various technology acceptance studies (Bauer et al., 2005, Muk, 2007, Wu and Wang, 2005, Yang, 2007).

In contrast to TAM theory, to understand the determinants of user acceptance of technology innovation, 'Innovation of Diffusion' Theory (IDT) (Rogers, 1995) can prove to be very helpful in understanding why some innovations are adopted at a much faster rate while others may not be readily accepted, in spite of their numerous advantages. The manner in which the innovations are perceived is also a significant factor in application to a wide range of innovations, although various studies have considered the perceived characteristics as the main factor influencing the adoption of innovation. The IDT also supports this assertion by stating that the user perception or beliefs held regarding these innovations play a major role in reaching a decision about accepting or rejecting certain technological innovation, as discussed by the IDT direction (Agarwal and Prasad, 1999).

The adoption of technological innovation in the information systems is often explained with the help of the theory of DOI (Rogers, 1995). Innovation of Diffusion theory (IDT) was used as a basis for the 'perceived characteristics of innovating' (PCI) by (Moore and Benbasat, 1991).

The 'perceived characteristic of innovation and diffusion of innovation' (IDT) model (Moore and Benbasat, 1991, Rogers, 2010, Compeau et al., 2007) is one of the

most recent works in the area of explaining and predicting the acceptance and use of information technology by end users. Eight different characteristics were explored through this theory, which combines all the components of these models into a single predictive structure. The combined structure was more powerful than the individual attributes in its prediction.

The PCI proposed by Rogers (1995) was used in the formulation of a research model in order to predict the levels of adoption of integrated 'one-stop-shop' utility management innovations by utility users and to explain their behaviours in this environment. The IDT and PCI measurement framework used in the previous research studies was adopted in this study. It is derived from the IDT framework found in previous research that suggests that certain attributes of an innovation would affect a user's opinion of the innovation prior to adoption (Straub et al., 1999). It has been proposed that 'innovations that are perceived by individuals as having greater relative advantage, compatibility, "trialability", and "observability" and less complexity will be adopted more rapidly than other innovations'(Rogers, 2002, p.990).

Potential users of online services usually evaluate an innovation on the basis of perceived characteristics demonstrated by the innovation and these affect their intention or willingness to adopt that innovation. An innovation will have a higher rate of acceptance in comparison to others if it is easy to use, less complex and compatible with the values and prior experiences of the users (Moore and Benbasat, 1991). The potential adopters can be assisted in developing the desired perception through workable communication channels that will lead to increased intention of adoption rather than rejection. The service providers are entrusted with a greater responsibility of providing more acceptable services related to the technology innovation and a proper

interaction interface in order to shape the perceptions of the user for increased online technology adoption.

In this study, the PCI based on IDT model has been used as the basis to investigate user perceptions towards acceptance and satisfaction with innovation of integrated 'one-stop-shop' utility management as a channel of online service delivery in utility.

## 3 THE CONCEPTUAL MODEL FOR OUR STUDY

In the context of innovation success in relation to online services delivery in utility, a priority is to investigate customer evaluations of service value according to their perceived benefit of online services and how the service delivery innovation can be managed to deliver a better customer acceptance of services online. It has been argued that a large percentage of existing online customers are not satisfied with the interaction (Bednarz, 2003, ICSA., 2001). Over the past three decades, researchers have investigated customer perception of interaction with the service provider interfaces, for example, web interface design, information quality, navigation, responsiveness, etc. (e.g., (McKinney and Yoon, 2002, Palmer, 2002).

In past research, to the best knowledge of the authors, no previous studies have examined online utility management websites. Therefore, this study has taken the initiative in proposing a new service delivery innovation with a focus on investigating customer intentions for accepting and adopting new technological dimensions by studying the factors of online utility management services on the Internet in order to determine the value perceptions from the users' perspective, as well as considering other utility stakeholder demands. 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. After consumers perceive a new service, they engage in an evaluative processes, adopt an attitude of acceptance or resistance, and then accept or reject the innovation due to perceived characteristics of that innovation, which can in part determine their future intentions.

The present study has been undertaken with a desire to highlight the future of an integrated utility management framework taking into account the innovations of a 'one-stop-shop' online service delivery approach. The research conceptual model (see Fig 1) provides an understanding of the utility customer's perception regards intention to use and accept the integrated 'one-stop-shop' utility management innovation through an investigation of their perceptions of the innovation. In particular, by investigating the utility customers' judgements and willingness to use the integrated 'one-stop shop' utility management innovation via a measurement of perceived determining characteristics of the new innovation (PCI) and a single point of online service delivery approach.

To justify the concentration on customer perception in the assessment of acceptance of the new innovation, we draw attention to the DOI and PCI Models (Moore and Benbasat, 1991, Rogers, 2010, Compeau et al., 2007). Similar studies that investigate the PCI on user perception towards a new innovation have applied the TAM theory from a recent extended PCI in Moore and Benbasat (1991) and Compeau et al. (2007) in order to study the utility user perception towards integrated 'one-stop-shop' utility management innovation on the Internet.

According to the theory of DOI and PCI, a close relationship exists between attitudes regards innovation characteristics and user perceptions to the innovation and those determinants immediately precede the prediction of intention to use the new innovation. Based on IDT (Rogers, 2010), there are eight perceived characteristics of

innovation that will lead to higher rates of new innovation adoption. The choice of attributes to enter our research model follows on from considerations found in established research. Transferring this idea to the investigation of intention to use the innovation of integrated 'one-stop-shop' utility management, PCI would, therefore, emerge as a core determinant of consumer intention towards innovation acceptance. This idea is supported by recent publications, which suggest that PCI is a factor in predicting innovation acceptance (Compeau et al., 2007). Therefore, based on the conceptual foundation provided by Rogers (1995) and from past research in electronic services adoption, the main research hypothesis is to explore the user's intention to use the innovation and how positively the online utility users perceive the new service delivery that provides a single point of access to all utility services. The user intention to use the innovation will be explored within the theoretical framework provided by Rogers (1995) and it is hypothesized that positive perception to technology innovation services will lead to early intention to use of the innovation. At the same time, negative perceptions will lead to resistance to the use of that innovation. Therefore, by considering the above main hypothesis, we formulate the following sub-hypothesis in order to measure in detail the user's perceived innovation characteristics of the innovation of 'one-stop-shop' utility management and to explore its composite effects on their overall willingness to use the innovation as illustrated in Fig. 1, as follows:

H0. A user's positively 'perceived relative advantage' (RA) of the innovation of integrated 'one-stop-shop' utility management.

H1. A user's positively 'perceived ease of use' (PEU) of the innovation of integrated 'one-stop-shop' utility management.

H2. The innovation of integrated 'one-stop-shop' utility management.is 'compatible with users values' (CMPV).

H3. The innovation of integrated 'one-stop-shop' utility management.is 'compatible with user's prior experience' (CMPE).

H4. A user's perception to 'communicability' (CMU) of the innovation of integrated 'one-stop-shop' utility management.is positive.

H5. A user's perception to 'measurability' (MSA) of the innovation of integrated 'one-stop-shop' utility management is positive.

H6. The innovation of integrated 'one-stop-shop' utility management is perceived positively as an innovation more open to trial amongst existing online utility websites and 'trialability' (TRI).

H7. Others use' (OU) experience will have effects on the user positive perception to the innovation of integrated 'one-stop-shop' utility management.

All the perceived characteristics of the innovation (PCI) of integrated 'one-stop-shop' utility management (H0-H7) will have will positive effect on user's intention to accept/adopt innovation.

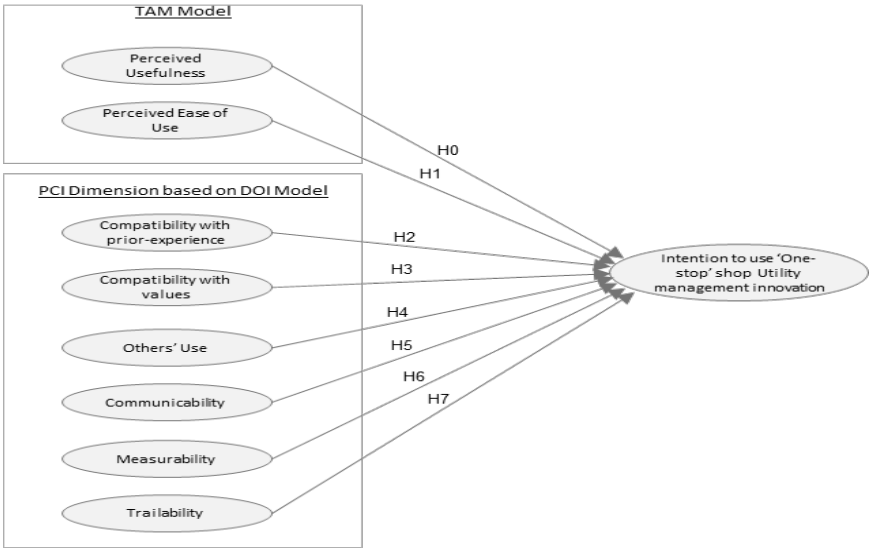


Figure 1: Conceptual model illustrating the measurement of user perceptions towards intention to accept the integrated 'one-stop-shop' utility management innovation

## 4 Towards an integrated 'one-stop shop' utilities management framework

The current environment of online services available to the utility user is fragmented and does not support the goals of efficient management of utility resources. In this existing method of interaction the users are required to deal with distributed sources of information provision and systems to carry out utility service management functions. The need for integrated information sources from different systems to be available and presented to the user in a comprehensive way is highlighted. Currently, online service delivery tends to provide the user with a limited ability to control or gain access to the resource data of all utilities on their property. Other utility stakeholders or sustainable communities have also been an unreliable and inefficient means in terms of an electronic infrastructure in facilitating the utilities user's engagement in relation to sustainability and urging users towards a more efficient use of utilisable natural resources.

The main reasons behind the challenges in the existing situation are as follows: (i) such challenges stem mainly from the fragmented nature of online services, even within single utility service organizations and departments; and, (ii) the service providers have focused mainly on shifting from traditional means of service delivery to interacting with their customer electronically via the Internet. In most cases, this transformation was achieved by shaping their internal processes to electronic ways 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 online services sources, accessing each service via a different website and by different service presentations, procedures and methods of accessibility and authentications (Fig. 1.a).

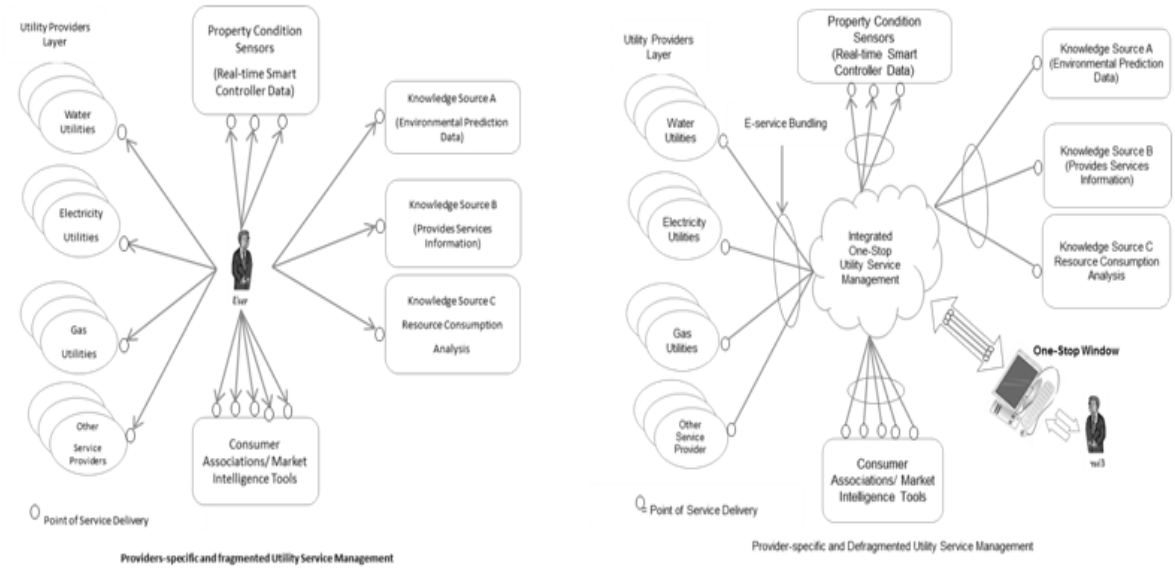


Figure 1: a) Present state of online user interaction to different utility service provider websites. b) Future trends in electronic service delivery strategies in the utility service provider's websites sector.

The current online service delivery paradigm limits the users from gaining the benefit of using the existing online services because of the increased effort needed to do the utility management tasks in their property, as well as the inconvenience of dealing with fragmented online services. The problems of user benefits and needs do not usually apply to a single utility authority or organization only. However, the user needs to be able to interact electronically with virtual utility service management tools that support the functions of defining user targets and they should be able to manage the utility resource use and monitor energy consumption. They also need to have control of the resource usage of utility services in 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 current situation, if householders want to manage their consumption,

for example, they have to interact with the several different utilities organizations in order to access relevant and up-to-date information, and the online utility services of their property (Fig. 1a). It also requires various different methods of access to different service provider portals in order to interact with the desirable online utility services provision, which are scattered, in some cases duplicated, and usually have different authentication.

The technological revolution is tending towards a single point of access to knowledge-based information sources that would enable the user to interact with a 'one-stop' online utility management source or single point of access to utility service management tools as a source of knowledge-based information capable of delivering value-added services to households and to all utilities stakeholders (Fig. 1b). Such an 'one-stop' service delivery method can be viewed as a comprehensive framework to achieving all of the parties' goals of environmental, sustainability, energy saving and national utility resource saving concerns.

The 'one-stop-shop' online service delivery approach indicates its importance in playing a role in, and capacitating, the creation of a virtual delivery environment that enables the elimination of existing boundaries between utility stockholders, including service providers and users. This rather favours interaction and information sharing between utility parties and sustainable communities, thus providing a comprehensive virtual service that is integrated and directed to user needs. The emergence of a new kind of electronic virtual environment offering an 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 the organizations themselves and the end users.

The future service delivery online as outlined in the 'one-stop-shop' paradigm should aim to overcome the challenges by: (i) including different points of view to issues of utility services management and resource consumption with consideration given to the dominance of fragmented online utility service provision; (ii) overcoming the deficiency of the current service delivery paradigm in providing value-added online services to all parties of utility stakeholders (householders, utility service providers, sustainable communities etc.); (iii) tolerating the limited infrastructure and standardization for sharing consumption or knowledge information with the current existence of administrative barriers to information access; and, (iv) dealing with the limitations that will emerge from a 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. This integration is essential to the practicality of building real-time information from different service providers' sources in order to provide a comprehensive feedback function.

Different components of the integrated 'one-stop-shop' utility management innovation framework are essential in depicting how the interaction between the various utility stakeholders would be shaped in order to provide the desired functionality required. The framework is designed to comply with the principles of user-centric service provision. The main components of such a framework includes: i) user information profiling; ii) integrated online services provision; and, iii) user-centric personalization, information prediction and recommendation service, feedback and tailored information, a knowledge exchange environment for all utilities parties and a framework for supporting utilities environmental sustainability.

## 5 Methodology and research design

The main purpose of this study was to understand the utility users' perception and to predict their intention of accepting the innovation of an integrated 'one-stop-shop' utility management source through the investigation of their perceived characteristic determinants towards the innovation (relative advantage, compatibility, complexity, "trialability", "observability", voluntariness, and image). Additionally, this paper explores not only the relationship between perceived characteristics of innovations but also serves to highlight the usefulness of PCI attributes of innovations in predicting online utility users' innovation acceptance. In order to accomplish this research objective, the various perceived characteristics of innovations (dependant variables) are identified from past literature where the relationships of dependent variables with user intention to accept the innovation (dependent variables) are tested via online surveys.

Another consideration of the surveys' applicability is the dominant methods used for data collection in many fields for exploring users' perceptions and attitudes (Isaac and Michael, 1990).

To contribute to the knowledge, we provide a definition of the innovation of the integrated 'one-stop-shop' utility management framework and conducted online surveys in order to test the hypothesis for predicting user' intentions to accept the innovation. Surveys are instrumental and widely used in the diffusion of innovation research. The "surveys may be methodologically adequate as they permit replication and some degree of cross-study comparability and can provide a basis for generalizing about the innovation process" (Tornatzky and Klein, 1982, p.29). The theoretical framework of the PCI with TAM theory is used as the basis for predicting user' intentions to accept the integrated 'one-stop-shop' utility management innovation. To collect data we designed a survey questionnaire by adapting the construct of PCI and

TAM attributes and also reduced PCI by excluding Image and voluntariness attributes for reasons that will be mentioned in section 5.3 in this paper.

## 5.1 Sample profile

The target population for this study consisted of both male and female users. Our research focus was on exploring the perception of existing or potential online utility users and their intention toward the innovation. The respondents were asked to fill out the online survey with detailed questions about their demographic variables, previous internet experience and skills, familiarity and experience with existing utility service providers' websites and the perception of future integrated utility services innovation that have a single windows of service delivery online.

The users' innovation acceptance was tested in the context of Saudi Arabia by using a survey method and collecting the data formed from 1193 random public respondents. The 1193 surveys response rate was complete and 1178 were used in the analyses where the survey was conducted online, and a real-time data validation check was pre-programmed in the survey websites. Fifteen responses were incomplete or gave the same rating for all items and their results were thus ignored. The respondents had an average of seven years of experience using the Internet, 63% were male, and the average sample age was 28. A total of 89% of the sample used the Internet every day. The majority (64%) use the Internet for seeking information about different topics and for socializing using different social networking services, while 7% have never used the Internet to conduct a transaction online (e.g. e-government, e-commerce, e-banking, e-health etc.). Twenty four percent of the respondents had a Master's degree or higher, and the majority of the respondents were educated to Bachelor degree level. A total of

79% were employed in private and public sector and 21% of the respondents were students or unemployed.

## 5.2 Data collection

The survey method used in this study includes four different parts. The first contained basic demographic characteristics, including gender, age, education level, marital status, family income, family composition, education and employment status. In the second part, the respondents were asked to provide detailed information about their internet or computer skills, attitudes towards and previous experience, and familiarity with the Internet in general. Further data gathered described the main motivational reasons for users that affect their intention to use online services on the Internet. Furthermore, questions were asked in order to determine the respondents' familiarity with online services and their level of experience in doing transactions online. In the third section of the survey, the respondents were asked to indicate their perception on the level of familiarity and usage of online utility management sources available in existing service providers' websites. The perception was measured according to the user awareness of the availability of online utilities services management, type of online services, frequency of use of that service, the main motivation or reasons (if any) for adopting that service and how they regard such existing services delivery methods, as well as if they were comfortable in their use. In the last section, the survey participants were asked to respond to questions on their perceptions to the innovation of integrated 'one-stop-shop' utility management and their intentions to accept the innovation. The survey questions were adopted from previous studies that are similar in the objective of investigating user perception and intention to use online services (Vijayasarathy, 2004, Shih, 2004, Ahn et al., 2005, Yu et al., 2005).

Prior to administering the survey, a pre-test took place in a small sample (18 respondents) of volunteer customers, colleagues, students and other types of online users. The pre-test provided feedback to important considerations regards the appropriateness of the items in the context of the questionnaire, the survey layout, time required to complete it, and the clarity of words or phrases used in the survey items (Vijayasarathy, 2004).

In the data collection phase, the survey was published online and the link was distributed to potential respondents via online communication tools; for example, social networking services, e-mails, chat facilities and by invitation for voluntary participation in e-forums. The participants were all volunteers and those that responded to the invitation were free to fill out the research survey.

### 5.3 Measuring dimensions of technological acceptance

Scholars have traditionally determined different factors that play a role in user acceptance of innovation in the e-commerce, e-banking, e-shopping and in private sector in general (Gefen et al., 2003, Van Slyke et al., 2004). Some studies have undertaken intensive research into the characteristics of user adoption of electronic services in e-government based on similar factors (Warkentin et al., 2002). Therefore, considering the similarities of the research area (namely, user adoption of electronic services in the private sector for e.g. electronic commerce, e-banking etc.), it is obvious that electronic services in a utility context is a part of electronic services in the private sector. Thus, user adoption of electronic services in a utility context can facilitate the determinant factors of DOI, PCI and TAM theories used in previous research in order to predict the user willingness to use the framework of integrated ‘one-stop shop’ utility management innovation. (Moore and Benbasat, 1991) It can also define perceived

characteristics of innovating (PCI) based on (Rogers, 1995) diffusion of innovation theory (DOI), which is widely used in the field of information systems to explain/predict user adoption of technology innovation. Based on similar previous research that measures/predicts a user's intention to accept technology innovation (Straub et al., 1999, Moore and Benbasat, 1991, Plouffe et al., 2001, Tornatzky and Klein, 1982, Van Slyke et al., 2004), it is obvious that different characteristics of innovation had a major effect on users behavioural intentions to use the innovation.

This study adopts the method of previous research and employs TAM, DOI theory and perceived characteristics of innovation (PCI) to predict user intention to accept technological innovation. The eight constructs under the perceived characteristics of innovation view are included in order to predict the users' intention towards using the integrated 'one-stop-shop' utility management innovation. However, the other remaining constructs of PCI ('image' and 'voluntariness') have been omitted from the PCI model that was suggested by (Moore and Benbasat, 1991), who firmly believe that the use of internet to conduct utility transitions is no longer a status elevating aspect socially and so the variable "image" is no longer relevant to the study of online behaviours. The utility user is also free from any pressures to use the innovation of integrated 'one-stop-shop' utility management, which further implies that the inclusion of the voluntariness construct is also irrelevant to such a study. Table 1 shows the definition of the independent variables that underpin the construction of this study questionnaire.

## 5.4 Data analysis

The collected data for this study was analysed using SPSS software (statistical package for social sciences) in order to explore the user intention to use the innovation of

integrated ‘one-stop-shop’ utility management. The SPSS tool presents the distribution of results provided by respondents’ according to demographic characteristics. Some survey items were reverse coded in order to be appropriate in the context of a positive effect on users’ intentions to accept the innovation. These items were: item RA4 ‘perceived relative advantages’, CMU2 of ‘communicability’, item OU3 of ‘others use’, and item CMPV1 of ‘compatibility of perceived values. The survey items were tested for both reliability and validity. The Cronbach alpha coefficient for each research construct was tested for reliability while factor analysis was used for construct validity (convergent and discriminant) for all the survey constructs. Hypotheses were tested using multiple linear regression analysis. The analysis was used to the best capacity for predicting the future 'user intention to use the innovation’. Furthermore, the critical important factors among perceived innovation characteristics (PCI) that influence utility users’ willingness to accept the innovation of integrated ‘one-stop-shop’ utility management were identified and ranked according to sorted means of dependent variables. A detailed view of the data analysis process is outlined in the following sections.

## 5.5 Reliability and validity

The reliability of analysis is important in the assessment of research survey questionnaires and in the verification of internal consistency of the variables (Chu and Murrmann, 2006). To ensure consistency and reliability, a theory-based definition of integrated ‘one-stop-shop’ utility management innovation and user intention determinants to accept the innovation were provided and used for each survey question in the questionnaire. The survey item’s 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 is in the range of 0 to 1, The closer the value is to 1.0, the more internal consistency of the items in the scale is suggested. The minimum sufficient Cronbach's alpha value is 0.6 as suggested by Nunnally and Bernstein (1978).

The items used in this survey were adapted from previous studies. The measurements of relative advantage were derived from Moore and Benbasat (1991), Huang, (2006), Horst et al., (2007), and Wangpipatwong et al., (2008). Other items of compatibility, complexity, communicability, measurability and other use are derived from other studies (Carter and Belanger, 2004, 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 derived from the studies of Moore and Benbasat (1991), Agarwal and Prasad (1997), and Venkatesh et al. (2003).

The items used to measure user intentions in the acceptance of technological innovation were adapted from Pavlou (2003) and Gefen and Straub (2000). A detailed list of the items instrumental to the survey is given in Table. 3. Each item scale was a Likert-type scale ranging from 1 (strong agree) to 5 (strong disagree).

The perceived characteristics of integrated 'one-stop-shop' utility management innovation were measured by questionnaire and included 52 items. These questions were composed of 14 items of 'perceived relative advantage' on a scale, an 11 item 'compatibility' scale (including 8 items 'compatibility with prior experience' (CMPE), 3 items of 'compatibility with value' (CMPV), a 9-item 'perceived ease-of-use' scale, a 5-item 'others use' scale, a 4 items 'communicability' scale, a 4 items 'measurability' scale, and a 5 items 'trialability' scale. The reliability of all the items was verified using Cronbach's alpha (Cronbach and Murphy, 1970). Table 2 illustrates the reliability

analysis results for the study constructs including the number of items analysed and alpha and standardized values.

All items in the questionnaire were assigned to their related perceived characteristic variable. The values of alpha in Table 2 show that all values were in the range of 0.803– 0.971, which shows that all of the items used to measure different constructs are internally consistent. Out of all the constructs, the variable 'perceived relative advantage' has the highest value of alpha (i.e. 0.971) and the variables communicability and 'measurability' had the lowest alpha values at 0.803 and 0.829, respectively. The reliability analysis results show the acceptable reliabilities for all variables used in this study (above 0.80). The statistics highlight the evidence that all variables are significantly reliable. This supports our assumptions about their reliability.

Table 2: Reliability Analysis (Alpha coefficients for factors resulting from factor analysis)

| PCI Constructs | Items | Cronbach's alpha (α) |
|---|---|---|
| Relative Advantage (RA) | 14 | 0.971 |
| Compatibility: | | |
| Compatibility with prior experience (CMPE) | 8 | 0.908 |
| Compatibility with values(CMPV) | 3 | 0.881 |
| Ease-of-use(PEOU) | 9 | 0.938 |
| Others' use (OU) | 5* | 0.889 |
| Result demonstrability: | | |
| Communicability (CMU) | 4 | 0.803 |
| Measurability (MSA) | 4 | 0.829 |

| PCI Constructs | Items | Cronbach's alpha (α) |
|---|---|---|
| Trialability(TRI) | 5 | 0.962 |
| * Originally this construct was measured with six items. One item was dropped to improve reliability. | | |

### 5.5.1 Content validity

The content validity was verified by a critical evaluation of the definition of each construct included in the survey by reviewing theories and research findings relevant to the user's technology acceptance and previous research studying the effects of perceived characteristics of innovation on intention to use the technology innovation. Afterward, the item content for each construct was adapted from existing scales in the relevant literature on online service adoption in similar fields of e-government, e-commerce, and e-banking. The surveys' construction and items contained therein were also validated by PhD research students whose area of interest was that of technology adoption. Therefore, the measurements used are believed to have sufficient content validity.

### 5.5.2 Convergent validity

In general, the aim of the validity analysis is to verify that the survey is instrumental in accurately measuring that which they are intended to measure. To analyse the validity of the survey's construction undertaken in this study, the eight perceived characteristics constructs (PCI) were evaluated according to their factor loading values using SPSS software. The factor loading results of all items values are given in the appendix (Table 3). The expected outcomes of factor loading analysis are a measurement of the strength of the items relationship with the relevant constructs. The items with a high value of loading indicate significant correlation of the items with the related constructs that were

loaded. In this study, the factor loadings for all items are illustrated in Table 3. The items loading values ranged from (0.607 – 0.908), which indicates that almost all of the items were loaded very well with their related construct.

### 5.5.3 Discriminate validity

Discriminate 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) suggest that the squared correlations between two different measures in any two constructs should be statistically lower than the variance shared by the measures of a construct. By adopting this suggestion, we test the discriminant validity of the instrumental survey items and related constructs. The results are presented in Table 4. All shared variances between any two constructs were less than the amount of variance extracted by one of the two constructs. Therefore, the constructs of the survey for this study had sufficient discriminant validity and are thus considered valid for further analysis in the prediction of future user intention to use the innovation of integrated 'one-stop-shop' utility management.

Table 4: Pearson correlation coefficients and discriminant validity test (diagonal elements are a square root of the AVE)

| Constructs | RA | CMPE | CMPV | PEOU | OU | CMU | MSA | TRI |
|---|---|---|---|---|---|---|---|---|
| RA | 0.809 | | | | | | | |
| CMPE | 0.042 | 0.734 | | | | | | |
| CMPV | 0.011 | 0.072 | 0.812 | | | | | |
| PEOU | 0.013 | 0.060 | 0.012 | 0.680 | | | | |

| Constructs | RA | CMPE | CMPV | PEOU | OU | CMU | MSA | TRI |
|---|---|---|---|---|---|---|---|---|
| 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 |

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).

While running regression analysis, the possibility of multi-collinearity problems was also checked. The Pearson correlation matrix for constructs of TAM, DOI and PCI on the integrated 'one-stop-shop' utility management was examined with regard to the extent of multi-collinearity problems (see Table 5). Multi-collinearity exists when the overall p-value may be significant but the p-value for each predictor may 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 5) is above 0.9. The highest squared correlation amongst the independent variables was 0.19 for the measure correlation between 'relative advantage' and 'complexity' of 'one-stop-shop' innovation. None of the squared correlations was close to 0.8 and thus no problem with multi-collinearity among the research variables was suggested (Hair Jr et al., 1995). Secondly, the p-value for each predictor is also significant. Moreover, the values of tolerance (all above 0.2) and the variance inflation factor (VIF) (all below 5) for each predictor confirmed that there was no evidence of significant multi-collinearity among the research variables.

Table 5: The variance inflation factor (VIF) and correlation matrix for a PCI dimension of integrated 'one-stop-shop' utility management

| Constructs | No. Items | Collinearity Statistics | | IU | RA | CMPE | CMPV | PEOU | OU | CMU | MSA | TRI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Tolerance | VIF | | | | | | | | | |
| IU | 1 | 0.735 | 1.512 | 1.000 | | | | | | | | |
| RA | 14 | 0.651 | 1.608 | 0.074 | 1.000 | | | | | | | |
| CMPE | 8 | 0.854 | 1.053 | 0.062 | 0.013 | 1.000 | | | | | | |
| CMPV | 3 | 0.751 | 1.854 | 0.023 | 0.018 | 0.457** | 1.000 | | | | | |
| PEOU | 9 | 0.594 | 1.654 | 0.037 | 0.191 | 0.054 | 0.065 | 1.000 | | | | |
| OU | 5 | 0.624 | 1.157 | 0.154 | 0.121 | 0.134 | 0.125 | 0.254* | 1.000 | | | |
| CMU | 4 | 0.934 | 1.780 | 0.128 | 0.244** | 0.264** | 0.465** | 0.015 | 0.125 | 1.000 | | |
| MSA | 4 | 0.585 | 1.990 | 0.018 | 0.065 | 0.397* | 0.019 | 0.054** | 0.354** | 0.036 | 1.000 | |
| TRI | 5 | 0.854 | 1.002 | 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-shop’ 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 $< 5$

## 6 Results and discussion

### 6.1 Correlation Matrices

Correlation is a statistical method that is used to measure and describe the relationship between two variables. Finding correlations among variables is important, but correlation itself does not necessarily imply cause and effect. The information given can only be taken as an indicator. Correlation analysis can either be applied independently or as a preliminary stage to regression analysis, it can also show which variables have closer relationships with the independent variable and should therefore be included in the model. Correlations among the eight PCI constructs, in the context of user’s perception towards acceptance of integrated ‘one-stop-shop’ utility management innovation, are presented in Table 5.

An initial correlation analysis was conducted in order to observe the relationship between the user perception to different characteristics of the integrated ‘one-stop-shop’

utility management innovation and their intention to accept/adopt these services. Table 6 shows the correlation of intention to use and perceived innovation characteristics. Eight innovation characteristics (Independent variables), 'perceived relative advantage' (RA), 'ease-of-use' (PEOU), 'compatibility with values' (CMPV), 'communicability' (CMU), 'trialability' (TRI), 'compatibility with prior experience' (CMPE) and 'measurability' (MSA) were positively correlated with the construct of user perception to use such an integrated utility management innovation and all were statistically significant. In addition, 'other use' (OU) partially correlated with the dependent construct of user perception to use the innovation and was also partially statistically significant. These correlations are all in the expected directions except for the 'other use' (OU) variable and they provide support for the set of hypotheses noted above.

Table 6: Correlation matrix for intention to use the of integrated 'one-stop-shop' utility management innovation and perceived characteristics

| Constructs | RA | 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 relevant factors, 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 is illustrated in the next section.

## 6.2 Multiple regression analysis

The data were 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 use intention (dependent variable) and user perceptions of an integrated 'one-stop-shop' utility facility (independent variables).

Assumptions of multivariate normal distribution, independence of errors and equality of variance were first tested. There were no violations of these assumptions. Multi-collinearity was not a concern with this data set, as confirmed earlier. There was no evidence of significant multi-collinearity among the research variables. Outlier influential observations were identified with leverage and studentized residuals, and 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 user intentions on potential usage and to investigate which perceived characteristics of innovation best predicted the user 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% of the dependant variables of user intentions for usage (Table 7). 'Perceived relative advantage' (RA), 'ease-of-use' (PEOU), 'compatibility with values' (CMPV), 'communicability' (CMU), 'trialability' (TRI), 'compatibility with prior experience' (CMPE) and 'measurability' (MSA) were statistically significant.

Table 7 presents values of beta, which indicate the individual contribution of each independent variable to the model. The independent variables RA, PEOU and CMPV have beta values of 0.441, 0.499 and 0.307, indicating that a change of one standard deviation in any of the variables will result in a change of these values on standard deviations, respectively, in the dependent variable ('user perception to use the innovation'). The beta weight indicated that these three independent variables were the strongest predictors with a level of significance (0.034) showing that those independent variables play a significant role in predicting the dependent variable. The direction of this effect is positive. Apparently, 'other use' (OU) such as user intentions for trying the innovation, influence of other users intending to try the services, self-efficacy and ability to use new innovation, etc. had little influence on user intention to use the integrated 'one-stop-shop' in this study. The beta values of all variables except 'other use' (OU) are positive, showing their significant positive individual contribution in bringing change in the dependent variable. The t-statistic along with 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 is it that the value of the beta could be zero.

Table 7: Regression coefficients on predicting user acceptance of integrated 'one-stop-shop' utility management innovation

| Hypothesis No. | Independent Variables | Standardized β coefficient | t-statistic | P-value |
|---|---|---|---|---|
| H0 | RA | 0.441 | 3.168 | 0.003 |
| H1 | CMPE | 0.231 | 4.230 | 0.019 |
| H2 | CMPV | 0.307 | 3.614 | 0.011 |
| H3 | PEOU | 0.499 | 1.432 | 0.020 |
| H4 | OU | 0.057 | 2.910 | 0.217 |
| H5 | CMU | 0.128 | 0.781 | 0.009 |

| Hypothesis No. | Independent Variables | Standardized β coefficient | t-statistic | P-value |
|---|---|---|---|---|
| H6 | MSA | 0.173 | 2.497 | 0.034 |
| H7 | TRI | 0.192 | 1.784 | 0.007 |
| Dependent Variable Adoption of 'one-stop-shop'; R = 0.973; R2 = 0.947; F = 0.021; Sig. = 0.000 | | | | |

Table 7 also shows the values of the model for the outcome variable (the F test), value of R, the corresponding $R^2$ and the adjusted $R^2$. The value software is the values of the multiple correlation coefficients between the independent and the dependent variables. For this model, the value of R in where all independent variables are included is 0.973. This value of R provides a measure of how well attitude can be predicted from the set of independent variables scores. The positive value of R confirms that seven of the eight independent variables in the research model can best predict the user intention to use the integrated 'one-stop-shop' facility. 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 variations in the user perception to use the innovation.

The value of F is the test of the relationship between independent variables and dependent variables, which is shown to be significant (since $F < 0.05$), so the independent variables go far in providing an explanation of the variation apparent in user perceptions towards use of the new innovation. It is concluded that all of the values confirm the significant good fit of the model.

6.3 Hypothesis testing and discussion

Having confirmed the structure of the various scales in terms of reliability, dimensionality and validity, we went on to test the hypotheses proposed in this research for exploring the utility users' intention to accept the innovation.

The first hypothesis (H0) referred to the relationship between users' 'perceived relative advantage' (RA) of innovation characteristics and intention for acceptance of the 'one-stop-shop' utility management innovation. The results obtained (see Fig. 4) show that, although the parameter sign obtained was as expected, the significance has a high level of reach ($p = 0.003$). For this reason, Hypothesis H0 had to be accepted. On the other hand, both the sign and the explanatory capacity of the parameter relating to perceived relative advantage with the dependent variable (intention to accept) attained satisfactory levels. Furthermore, mention should be made of the high $R^2$ values obtained ($R^2 = 0.947$), as well as the good fit of the model.

The second hypothesis (H1) has "a user's positive perception of the 'ease of use' (PEOU) will affect their intention to accept/use the innovation". According to the statistical results PEOU significantly affects users' perception about intention to accept/use the innovation. The beta value 0.499 shows that one unit increase in PEOU may result in a 0.499 unit increase in perceptions of users. This suggests that if the integrated 'one-stop-shop' utility management innovation is easy to use and no difficulty is faced in their functioning, then the users will perceive it to be of superior added value and are more inclined to intend to accept it. Thus H1 is accepted.

It was hypothesis that the 'compatibility with values' (CMPV)/'prior experience' (CMPE) feature of the integrated 'one-stop-shop' innovation positively affects perceptions of users' regards intention to accept/use the innovation (H2 and H3). 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 CMPV and CMPE will cause a 0.307 and 0.231 unit increase in positive perception to the innovation respectively. This suggests that well-designed compatibility features of the

integrated ‘one-stop-shop’ utility management innovation strongly affect the positive perceptions of its users. Thus H2 and H3 are accepted.

This is following by hypothesis (H4) that “a user’s perception to innovation ‘communicability’ (CMU) will affect their intention to accept/use the innovation”. By referring to statistical analysis results, the positive beta value of variable CMU, it is confirmed that one unit increase in CMU will result a 0.128 unit increase in positive perception to the innovation acceptance. Therefore, H4 is supported.

The following test result of hypothesis (H5) that “a user’s positive perception to the innovation ‘measurability’ (MSA) will positively affect their intention to accept/use the innovation”, is shows a positive beta value of 0.173, which supported that if users perceive the ability to measure the value of the innovation then they are more likely to have positive perceptions and intention to use that innovation.

It was also hypothesised that “a user’s positive perception of the integrated ‘one-stop-shop’ innovation ‘trialability’ (TRI) will positively affect their intention to accept/use the innovation” (H6). As conclude from the statistical analysis, the variable TRI was significantly affects perceptions of users’ in relation to their intention to accept/use the innovation. The positive beta value shows that one unit increase in TRI will results 0.192 unit increase in positive perception to innovation acceptance. Thus H6 is supported.

However, the hypothesis (H7) that “the effect of ‘Other use’ (OU) positive experience to the other innovation will positively influence the user’s intention to accept/use the integrated ‘one-stop-shop’ innovation”. The statistical results show that influence of ‘OU’ prior-positive experience to a new the innovation feature on user intention to accept the integrated ‘one-stop-shop’ innovation have a weak beta value of

0.057. This indicates that this factor is not a significant effects user perceptions to accept the innovation. Thus, H7 is not supported.

Most hypotheses exceeded their significant acceptance levels, suggesting that the research on the user innovation prediction model positively yielded results that accurately describe a user's willingness to accept the new 'one-stop-shop' innovation. The only exception was the 'other use' (OU) construct, whose value was slightly less than 0.06. Seven of the hypothesized eight paths (see Fig. 4) are significant at the 0.01 or 0.05 level. Fig. 4 are displays all relationships among the studied constructs, which shows variance in user's perceptions towards innovation acceptance was 94.7%, made up by categories RA, PEOU, CMPV, CMPE, CMU, MSA and TRI, the first four of which are seen to explain 67% of the variance of intention to accept the innovation, and the left three CMU, TRI, and MSA account for 32%.

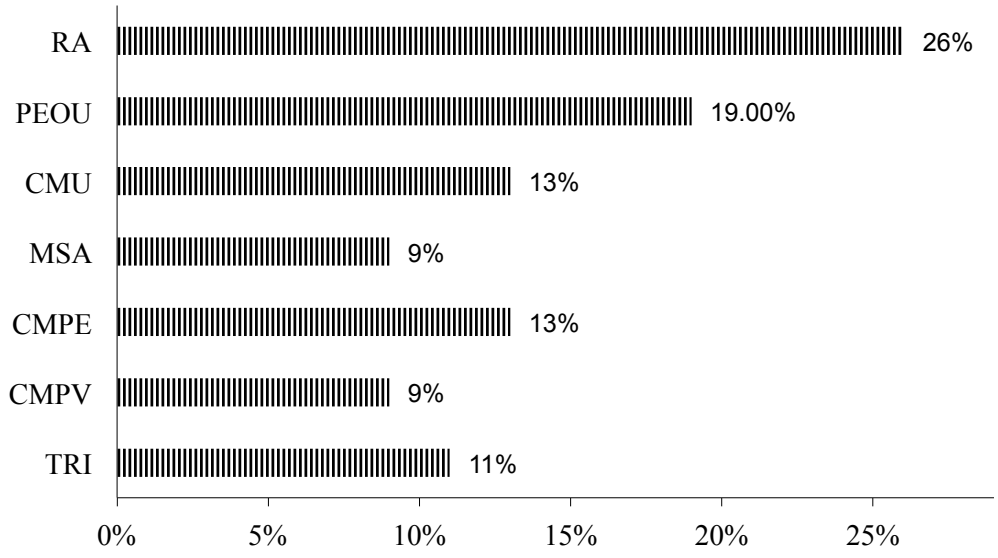


Figure 2: Comparative results of relative effects of each determinant on the dependent variables

Comparing the relative effects of each determinant on the dependent variables (see Fig. 2), user intention to accept the innovation was separately explained by RA (26%), PEOU (19%), CMU (13%), and TRI (11%). In addition, regarding the

innovation users acceptance, 22% was explained by 'compatibility', 13% by CMPE and 9% by CMPV, separately. Furthermore, another 9% was explained by MSA.

Table 8 indicates that seven of the eight hypotheses were significantly supported. Only H7 was not empirically supported by the data. The results indicate that the 'other use' (OU) of innovation did not significantly potentially affect the users' perception. The hypothesized relationships found in the results and their values as tested are illustrated in Fig. 4 and Table 8 in the Appendix.

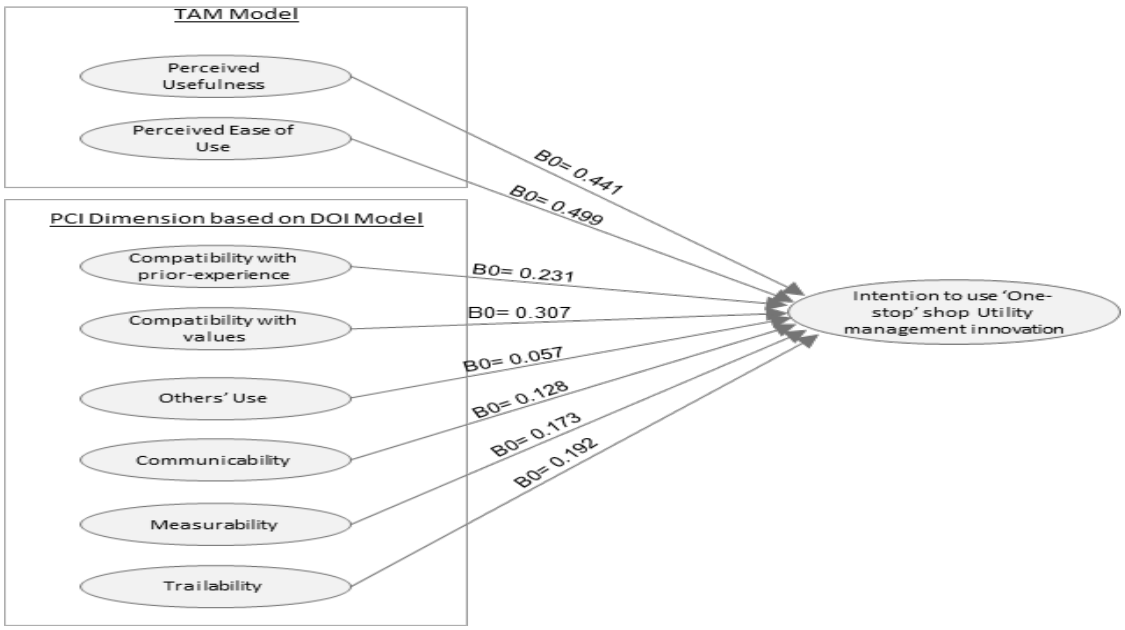


Figure 4: Predicted model for user intention to adopt 'One-stop' integrated utility management innovation

## 7 CONCLUSION

This study proposed and tested an innovation acceptance model in the context of online utility management services. Since the purpose of this research was to investigate the user willingness to use the innovation of 'one-stop-shop' utility management, a previous theory of online service adoption was employed in predicting user intention to use the innovation. This approach differs in some aspects to past research on exploring a user technology acceptance that focusses mainly on ICT acceptance in general

(Pavlou and Fygenson, 2006, Hung et al., 2006, Taylor and Todd, 1995). This study is pioneering with respect to predicting innovation acceptance in the newly emerging context of the online service delivery paradigm in utility services. The results found in the present study differ from those in previous studies because the intelligent online service delivery approach is embedded in the design of the integrated 'one-stop-shop' utility management innovation. This study was intended to be a value driven framework by providing a public service to the users as well as for all utility stockholders. The significant effects of both 'perceived relative advantage' (RA) and 'perceived ease-of-use' (PEOU) on intention to accept the innovation were observed. Although previous studies found 'perceived relative advantage' (RA) to have a stronger influence than 'perceived ease of use' (Taylor and Todd, 1995, Hung et al., 2006, Bhattacherjee, 2000), this study found a similar level of influence from these two beliefs. Hence, in the case of this innovation of integrated 'one-stop-shop' utility management, both 'perceived relative advantage' and 'perceived ease of use' may have a similar level of influence in the prediction of user intention to accept the innovation. The results of this study clearly support the notion that an increase in value-added online services to users can significantly affect attitude 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). 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, support the results of this study. Hung et al. (2006) found that compatibility has a significant effect on attitude in the context of online services in e-government. Hence, we conclude that the compatibility finding led us to infer that whether previous experiences and their

existing values are necessary conditions to consider when dealing with online utility management innovation fits with users' information technology needs, Additionally, the effect of innovation ‘communicability’ (CMU) on intention to accept the innovation is also significant. Compared with results in the context of user acceptance of online services in e-business (Hernandez and Mazzon, 2007), user acceptance of the proposed integrated ‘one-stop-shop’ facility is highly attributable to the users' perceptions regards innovation ‘communicability’. One possible explanation is that potential users expect a higher level of communicability with service providers and other utility stakeholders before accepting the innovation.

Consistent with our hypothesis, innovations with higher levels of ‘trialability’ (TRI) provided significantly more positive perceptions towards the ‘one-stop-shop’ utility management innovation acceptance. These findings support prior research which found a significant direct relationship between ‘trialability’ and innovation acceptance (Hsu et al., 2007). Also consistent with our hypothesis was the finding of the importance of higher levels of ‘measurability’ (MSA) as which is consistent with Hernandez and Mazzon (2007).

The most interesting finding suggests that ‘other use’ (OU) does not have any significant effect on user perceptions to use the innovation. Such a finding contrasts with findings on user acceptance in the context of influence of ‘other use’ to users intentions to accept the innovation in similar online services acceptance studies (Venkatesh et al., 2003, Hsu et al., 2007). One possible explanation for that utility users have already accumulated experience of similar online services advantages in other online services provided by e-commerce, e-government, e-shopping, e-health etc.

This study has successfully identified the key factors of a ‘one-stop-shop’ utility management innovation that will play a major role in user willingness and intention to accept

it. A more detailed research should be undertaken into the integration and operability of services delivery in the utilities sector across different administrative boundaries between agencies in order to deliver utility users a unified environment as a base for a successful future online service delivery in the utility management context and to increase the adoption of service delivery. Such a study should also focus on considering the causal effects of innovative technology on the users' perceived characteristics of the innovation and their relationship to user satisfaction and service adoption.

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## Appendix

Table 1: Innovation characteristics measurement constructs of integrated 'one-stop-shop' utility management, relevant models, and references

| Base Theory | | PCI in IDT Model (Rogers, 2010, Rogers, 1995) | PCI Constructs (Moore and Benbasat, 1991) | Revised PCI Constructs (Compeau et al., 2007) | Definition of Construct | Relevant studies |
|---|---|---|---|---|---|---|
| TAM | Perceived Usefulness | Relative Advantage | Relative Advantage | Relative Advantage | The degree to which an innovation is perceived as better than the idea is 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 | Defined as "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 | Complexity is defined as "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 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 experience, belief 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, 2004, 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 to accept. Innovation Observability will be also influenced by their peers' use of the innovation. The more potential users see of their peers use the innovation (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 | PCI in IDT Model (Rogers, 2010, Rogers, 1995) | PCI Constructs (Moore and Benbasat, 1991) | Revised PCI Constructs (Compeau et al., 2007) | Definition of Construct | Relevant studies |
|---|---|---|---|---|---|
| | **Trialability** | **Trialability** | **Trialability** | **Trialability is defined as "the degree to which an innovation may be experimented with on a limited basis". New ideas that can be tried on the installment 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 trail 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** | **Defined as "the degree to which use of the innovation is perceived as being voluntary, or if free will". When examining the diffusion of innovations a consideration 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 |

Table 3: Factor analysis of research variables and detailed variable items of perceived characteristics of One-stop innovation

| S No. | Items | Description | Factor Loadings | Detailed item definition |
|---|---|---|---|---|
| Perceived Relative Advantage (RA) | | | | |
| 1 | RA0 | Time saving | 0.876 | Using the 'One-stop' utility management enables me to save my time and to accomplish tasks more quickly? |
| 2 | RA1 | 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 services provider websites. |
| 3 | RA2 | Communication channel | 0.762 | By using 'One-stop' online utility management I get better service than from service provider websites or branch office. |
| 4 | RA3 | Quality of services | 0.734 | Using the 'One-stop' utility management will improve the quality of my utility resource management I am looking for. |
| 5 | RA4 | Perceive usefulness | 0.876 | I find 'One-stop' utility management not useful. |
| 6 | RA5 | Perceive consequences | 0.876 | I find the use of 'One-stop' utility management will have superior features than existing utility services providers' websites and will have a positive impact on my utility management function. |
| 7 | RA6 | Perceived Value | 0.884 | Would you value integration of online utility services in 'One-stop' single windows of interface do the utilities management on the internet |
| 8 | RA7 | 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 | RA8 | 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 | RA9 | 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 services according to my profile and utility usage targets that I have defined. |
| 11 | RA10 | Services responsiveness | 0.668 | Using the 'One-stop' utility management enables enable me to have responsive and ad-hoc information about services choice and live utilities usage feedback |
| 12 | RA11 | Functionality Features | 0.842 | Using the 'One-stop' utility management enables enable me to achieve my goals of saving costs and resource usage depreciation for environmental reasons |
| | | User-profile and utility usage target sitting | 0.798 | I value the initiating the function that enable the sitting utility usage target within the integrated utilities service management innovation, and it make it easier for me to control my utility usage. |
| 13 | RA12 | Controllability | 0.657 | Using the 'One-stop' Online utility management gives me greater management tools to control over my utility consumptions? |
| 14 | RA13 | Service satisfaction | 0.813 | Overall, I find using the 'One-stop' Online utility management to be advantageous in performing my home utility management tasks |
| Compatibility with Prior experience (CMPE) | | | | |
| 15 | CMPE 0 | Compatibility with existing e- utilities management | 0.829 | During the last 12 months, I have used the existing online utilities service management websites and I feel it is compatible with my skills. |
| 16 | CMPE 1 | Skills experiences | 0.772 | I am familiar with managing my utilities services online and it is compatible with my skills experiences? |
| 17 | CMPE 2 | Compatibility with new innovation | 0.900 | Using the One-stop utility management was a new experience for me |
| 18 | CMPE 3 | Compatibility with new innovation | 0.778 | Using One-stop utility management was different from everything that I have experience with before? |
| 19 | CMPE 4 | Compatible of new innovation | 0.867 | For me, using innovation of 'One-stop' integrated utilities service management to manage my utilities portfolio will... be a positive experience |

| S No. | Items | Description | Factor Loadings | Detailed item definition |
|---|---|---|---|---|
| **20** | **CMPE 5** | **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** | **CMPE 6** | **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** | **CMPE 7** | **Overall experience compatibility** | **0.719** | **Please rate your overall level of your experience compatibility with the innovation of integrated 'One-stop' utilities management** |
| | | **Compatibility with Values (CMPV)** | | |
| **23** | **CMPV 0** | **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 believes about efficient management of my utility resources and control resource usage?** |
| **24** | **CMPV 1** | **Innovation Compatibility with values** | **0.661** | **The integrated 'One-stop' utility management provides capabilities that conflict with my values.** |
| **25** | **CMPV 2** | **Overall Innovation Compatibility with values** | **0.831** | **Using the integrated 'One-stop' utility management is completely consistent with my values.** |
| | | Perceived Ease-of-use **(PEOU)** | | |
| **26** | **PEOU 0** | **Accessibility** | **0.897** | **I am interest to have an integrated 'One-stop' utilities management innovation with on-click admin to all my utilities accounts?** |
| **27** | **PEOU 1** | **Functionality ease-of-use** | **0.764** | **Using the integrated 'One-stop' utility management innovation makes it easier to do my utility management tasks?** |
| **28** | **PEOU 2** | **Interface attractively and effortless** | **0.614** | **I would find integrated 'One-stop' utilities management innovation to be easy to interact with, and enable a least effort needed to manage my utilities** |
| **29** | **PEOU 3** | **Familiarity** | **0.831** | **I find it is easy to learn how to use the integrated 'One-stop' utility management innovation.** |
| **30** | **PEOU 4** | **Integrated services provision** | **0.697** | **In case of grouping online utilities services in one place, does that make you better use and adopt these services?** |
| **31** | **PEOU 5** | **Personalized online services provision** | **0.745** | **Using a personalized online services provision will contribute in making the online utility management easy and friendly to use?** |
| **32** | **PEOU 6** | **Payment transactions** | **0.840** | **Using single point of utility bills payment in 'One-stop' utility management would be easier for me to conduct transactions and enable me to pay more quickly.** |
| **33** | **PEOU 7** | **Information sharing and communication** | **0.678** | **I believe the integration of all utilities service online in 'One-stop' utility communication environment will benefit to enable ease of interaction with all utilities parties (service providers, services regulator, sustainable community…etc.)** |
| **34** | **PEOU 8** | **Overall ease-of-use** | **0.897** | **Overall, I believe that the One-stop utility management is easy to use.** |
| | | 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 of 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 advices or recommendations** |
| | | 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 resources saving** |

| S No. | Items | Description | Factor Loadings | Detailed item definition |
|---|---|---|---|---|
| **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 benefit with other third party that is providing service integration and advices?** |
| **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.** |
| Measurability **(MSA)** | | | | |
| **44** | **MSA0** | | **0.873** | **It is easy for me to realize the outcomes benefit of using the 'One-stop utility management innovation.** |
| **45** | **MSA1** | | **0.840** | **The results of using 'One-stop' utility management innovation are easy to measure.** |
| **46** | **MSA3** | | **0.654** | **The results of using 'One-stop' utility management innovation are obvious.** |
| **47** | **MSA5** | | **0.714** | **The results advantages of using 'One-stop' utility management innovation are easy to measure and evaluated.** |
| Trialability **(TRI)** | | | | |
| **48** | **TRI0** | | **0.786** | **I am willing to try to use it** |
| **49** | **TRI1** | | **0.753** | **I am likely willing to try out a various 'One-stop' utility management functionality to manage my utility services.** |
| **50** | **TRI2** | | **0.736** | **I have the willing to try the innovation to participate with other utilities stakeholders to archive better efficient use of utility resources** |
| **51** | **TRI3** | | **0.845** | **I have had many opportunities to try out the 'One-stop' utility management innovation** |
| **52** | **TRI4** | | **0.792** | **Please rate your overall interest level to try it** |
| *** Originally this construct was measured with five items. One reverse worded item was dropped to improve reliability.** | | | | |

## Table 8: Results of the study hypotheses being tested

| Hypotheses | | Results |
|---|---|---|
| Main H: | The composite user's perception to the new innovation characteristics will positively affect their intention to accept/adopt the innovation | Supported |
| H0 | A user's perceived relative advantage (RA) -> Intention to accept the one-stop innovation | Supported |
| H1 | A user's perceived Innovation ease of use (PEOU) -> Intention to accept the one-stop innovation | Supported |
| H2 | Perceived compatibility with values (CMPV) -> Intention to accept the one-stop innovation | Supported |
| H3 | Compatibility with users' prior experience (CMPE) -> Intention to accept the one-stop innovation | Supported |
| H4 | Innovation communicability (CMU) -> Intention to accept the one-stop innovation | Supported |
| H5 | Perceived the innovation measurability (MSA) -> Intention to accept the one-stop innovation | Supported |
| H6 | Innovation trialability (TRI) -> Intention to accept the one-stop innovation | Supported |
| H7 | Others' use (OU) experience of the innovation -> Intention to accept the one-stop innovation | Not supported |

## Table: Mean rank of 'One-stop' PCI influencing customers perception of online services adoption

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