Technology knowledge and governance: Empowering citizen engagement and participation

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TECHNOLOGY KNOWLEDGE AND GOVERNANCE: EMPOWERING CITIZEN ENGAGEMENT AND PARTICIPATION[å]

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TECHNOLOGY KNOWLEDGE AND GOVERNANCE: EMPOWERING CITIZEN ENGAGEMENT AND PARTICIPATION

Abstract

The term technology knowledge (T-knowledge) is used to describe knowledge about and the ability to operate specific technologies such as the Internet. T-knowledge also includes the ability required to operate particular technologies. T-knowledge can potentially improve engagement by helping the user to make his/her personal decision in an increasing range of domains. The main purpose of this paper is to investigate the extent to which an extended Technology Acceptance Model (TAM) facilitates t-knowledge in e-government services offered by City Halls. We also investigate whether t-knowledge has an effect on citizen engagement in government initiatives. In this research, an extended TAM is developed to test t-knowledge in online e-government services employing a sample of 307 citizens who used the benefits advisor tool provided by a Spanish City Hall. The results suggest that the core constructs of TAM (perceived usefulness, ease of use and attitude) significantly affect t-knowledge. This study also reveals a general support for t-knowledge as a determinant of citizen engagement.

Keywords: technology knowledge, citizen engagement, technology acceptance model, end users**.**

1. Introduction

Citizen engagement has been defined as individual and collective actions designed to identify and address issues of public concern (Adler and Goggin, 2005). Citizen engagement refers to the ways in which citizens participate in the life of a community in order to improve conditions for others or to help shape the community's future. A common theme in the field of local governments refers to the use of information and communication technologies (ICT) as a means to foster citizen engagement (Jennings and Zeitner 2003). There are enough positive things about ICT as enablers for citizens to get more involved in public life, facilitate formation of social networks (social capital), and contribute to participatory and deliberative democracy (e.g., Ward *et al*., 2003; Foot and Schneider, 2006; Park and Perry, 2008). Noveck (2010) argues that ICT help make valid and reliable information available to citizens for better governance, supporting new forms of collective action which lead to a new form of collaborative democracy.

A closer examination, however, shows that most initiatives facilitated by ICT have been characterised by low levels of citizen engagement (e.g. Torres *et al.*, 2005; De-Miguel-Molina, 2010; SIPA, 2011). A possible explanation for these findings may relate to the fact that although the majority of municipal governments have their own ICT and websites to provide public information to citizens (Moon and Norris, 2005), there has been no emphasis on developing the knowledge required to use such technologies.

The term technology knowledge (T-knowledge) refers to those capabilities which potentially enable technology users to find the right answer in the right place at the right time with the support of a specific technology (Cegarra *et al*., 2011). In the case of ICT this t-knowledge includes knowledge of operating systems and application software, as well as knowledge of computer hardware and the ability to install and remove peripheral devices, install and remove software programs, create and archive documents (Szulanski, 1996; Sharma, 2000; and Nohria and Gulati, 1996).

T-knowledge, then, is not only content to be learned but the vehicle through which the intellectual processes embedded in technological activity can themselves be used. T-knowledge can potentially, improve the skills required to operate particular technologies, which in turn helps citizens make their personal decisions in a growing range of domains including governance. In the context of this paper, t-knowledge is understood to be created, used, and communicated through such processes as perception, attitude or understanding of the technology (Martinez-Caro *et al*., 2012). Furthermore, it is our understanding that without the support provided by a positive attitude towards technologies, t-knowledge may not be created. Attitude in this context is that part of learning process that allows people to understand the value of technologies (Davis *et al*., 2009), and it allows individuals to make judgments and impressions about ICT and, by extension, the creation of t-knowledge.

The technology acceptance model (TAM) provides a good basis to explain the adoption of new technologies. The TAM was originally conceived by Davis (1989) and suggests that perceived usefulness of ICT and perceived ease of use are major determinants that

affect individual's attitude and intention to use ICT. Perceived ease of use is also suggested to have an impact on the perceived usefulness. However, despite the opportunities that TAM potentially offers for the understanding of t-knowledge, few, if any, studies have considered the ways in which the creation and use of t-knowledge can be facilitated through the implementation and use of the TAM. Despite the amount of academic research dedicated to examining the determinants of information technology acceptance, and to TAM in particular, very little research has been conducted on City Halls to help identify how t-knowledge may be created by citizens.

Our study addresses this question "What is the nature and strength of the relationship between citizen engagement and t-knowledge?" and "What role –if any, does the core concepts of TAM play in such a relationship?". These questions are examined through an empirical investigation including 307 citizens who used a particular egovernment tool, that is the Benefits Adviser tool, within a Spanish City Hall. A modified TAM is developed and tested by using the Structural Equation Modelling (SEM) approach. The concepts of citizen engagement and t-knowledge are discussed in detail in the following section. Section 3 investigates the development of hypotheses as to how the TAM contributes to t-knowledge. Details of the survey which was used to collect data required to test the models is presented in section 4. The results of testing the models are presented in section 5 which are subsequently discussed section 6.

2. The proposed research model

2.1. The research context

T-knowledge refers to a fuzzy set of skills including information resources enabling better utilization of technology infrastructures (see Ropohl, 1990; Cross, 2001; Vries 2003). For example, t-knowledge may include previous experience of how to install and remove peripheral devices and this will influence later on skills required in individuals to operate particular technologies. Put another way, it is through activity that t-knowledge is defined; it is activity which establishes and orders the framework within which technology infrastructure is used (Herschbach, 1995). It should be noted here that t-knowledge includes both technical know-how as well as a systematic knowledge about the interrelationship between technical objects, the natural environment and social practice (Putnam 2000; Jennings and Zeitner 2003; Bennett 2008). For example, t-knowledge about online council services such as bingo and tombola can help older people by preventing and alleviating social isolation and loneliness among older people. In this paper, t-knowledge involves not only the skills citizens need to achieve a minimum utilization of Spanish city council websites, but also involves making the citizen aware of electronic policies, processes, programs, and services and generating some positive feelings.

In countries like Spain, the factors that influence the nature and structure of the Spanish Public Administration (e.g., demand, costs, regulations, organisation, etc.) are undergoing rapid change. Recent reforms have regionalised the Spanish Public

Administration in order to improve response times and increase the participation of communities in the development and management of public services –including electronic online services, at regional and local levels (Cohen and Nijkamp, 2004). In Spain, most if not all municipalities (called "municipios") are engaged in the development and delivery of efficient services to the public. According to a report released by the Press Office of the Spanish Ministry for Public Administrations in September 2011 (MAP in Spanish, 2011), Spain found itself among the ten most advanced countries in this area and ranked fifth in Europe in terms of both availability and sophistication of online public services (SIPA, 2011).

2.2. ICT and citizen engagement with public services

Researchers agree that ICT has considerable potential to contribute to learning efficiency, gains and cost reductions for local governments (e.g., Criado and Ramilo, 2003; Carter and Belanger, 2005; Badri and Alshare, 2008; Lean *et al*., 2009). For example, official town websites are highly visible manifestations of city developments and are used for collecting and paying money according to the regulations of city councils (Lean *et al*., 2009). These perspectives also provide a view of ICT as a driver for public administration to become more open and transparent, to enable democratic participation and networked activism (Land, 2009), to become more service-oriented by providing personalised and inclusive services to each citizen (e.g., Ward *et al*., 2003; Foot and Schneider, 2006), to become more productive and to deliver maximum value for taxpayers' money as well as for any ICT investment (Park and Perry, 2008).

The term user engagement can be defined as a phenomenon through which individuals formulate meanings and actions that reflect their desired degree of participation in individual and societal decision-making processes (Gatautis et al., 2011). A particular type of user engagement is citizen engagement. It may be defined as individual and collective courses of action that are designed to identify and address matters of public concern (Hays, 2007). From this perspective, citizen engagement includes efforts to directly address an issue, work with others in a community to solve a problem or interact with the local institutions. Another way of describing this concept is the sense of personal responsibility individuals should feel to uphold their obligations as part of any community (Putnam, 2000). This means that citizen engagement can take many forms, from organisational involvement to electoral participation, individual volunteerism or engagement with new activities of the government. Gaventa and Barret (2010) classify the outcomes of citizen engagement in four broad areas: 1) the construction of citizenship; 2) the strengthening of practices of participation; 3) the strengthening of responsive and accountable states; and 4), the development of inclusive and cohesive societies.

The above definitions suggest that there are different definitions of citizen engagement but common elements include knowledge of and discussion of public affairs (Jennings and Zeitner 2003; Mossberger *et al*., 2008). In the context of this paper the term citizen engagement refers to the use of modern ICTs to empower the socio-technological and cultural capabilities of citizens giving the possibility to individuals to deal with local affairs concerning issues such as pollution, schools and street designs (Zukin *et al*. 2006; Lim, 2007). Nowadays, Spanish city council websites encompass any type of

mutual communication or interaction between citizens, business and public organisations and because of this, the city council website is perceived as the use of ICT for controlling electronically public administration processes from both internal and external perspectives (Criado and Ramilo, 2003; Claver *et al*., 2008). With this in mind, citizen engagement can be supported by the use of city council websites in local government affairs, for example, weblogs provide 'guides', 'resources' and 'reviews' for particular citizens to contribute their own ideas, suggestions, and requests.

In Spain, a number of technology projects have been developed to help users gain more engagement with public services through the use of websites. The *Avanza2*[1] and *Avanza Local* Plans give testimony of how local and regional governments in Spain have been continuous adopters of ICT in recent years (Torres *et al.*, 2005; De-Miguel-Molina, 2010; SIPA, 2011). However, when faced with these technological projects, most people react in one of two ways. They either recoil from anything new, claiming that it is unnecessary or too complicated or that it somehow makes life less personal. Or they learn to adapt to the new technology and, eventually, wonder how they could possibly have existed without it. Take Spanish city council websites as example. For many citizens, these websites still give a frightening sense of a future in which all decisions will be taken by computers. This may be because they seem mysterious, and difficult to understand (De-Miguel-Molina, 2010). Ask most citizens, what can you use a city council website for, and you usually get vague answers about how "they give you information of a general nature and with promotional or political agenda that does not

[1] http://www.planavanza.es/avanzalocal/Paginas/Index.aspx

contribute directly to take advantage of the relational and interactive capacity of the Internet" (Gandía and Archidona, 2008).

Considering the arguments above, a possible explanation for the low disclosure levels among Spanish city council websites may relate to the website strategy and implementation adopted by Spanish city councils, and how such strategies have been associated with low (or non-existent) level of knowledge in multimedia technology (Gandía and Archidona, 2008). In fact, even those of us who are familiar with city council websites, and use them in our daily work, have very little idea of how they actually work. T-knowledge arises from, and is embedded in, human activity (Herschbach, 1995), as Landies observes, while the intellect is at the heart of the technological process, the process itself consists of "the acquisition and application of a corpus of knowledge concerning technique, that is, ways of doing things" (1980: p. 111).

The initial stages of the implementation of ICT-based services in the local government environment can be difficult. However, assuming that most technical obstacles are gradually overcome, the question that remains is whether people are willing to use these new technological advancements (Suki and Ramayah, 2011). Until now, little attention has been paid to the importance of positive attitudes in learning about ICT and, as a consequence, enhancing t-knowledge. However, the capabilities required by end users with potentially a low level of technical ICT skills cannot always be achieved by education and training strategies or simply by hanging up a sign advertising ICT support, and waiting for citizens to request it (e.g., Criado and Ramilo, 2003; Carter and

Belanger, 2005; Badri and Alshare, 2008; Lean *et al*., 2009). As Bitner *et al*. (2002) point out, effective and successful self-service technologies are those that have been designed and implemented both considering the technical capabilities of end users and, especially, addressing the challenges of keeping users' motivations and meeting their expectations.

2.3. Measuring citizens' acceptance of ICT as a mechanism to engage with public services

One of the most frequently employed models for research into new information technology acceptance is the Technology Acceptance Model (TAM), first introduced by Davis (1989). Overall, TAM provides an informative representation of the mechanisms by which design choices influence user acceptance, and should therefore be helpful in applied contexts for forecasting and evaluating user acceptance of ICT. This model applies Fishbein and Ajzen's Theory of Reasoned Action (TRA) to explain the pattern of voluntary information system usage at an individual level (Kim and Chang, 2007). TAM suggests that when users are presented with a new technology, their decision about how and when they will use it is determined by assessing their beliefs, attitudes and intentions (Davis, 1989).

Attitude towards using a technology (A) was defined by Davis (1989) as "the degree of evaluative affect that an individual associates with using a system in his or her job". Attitude is determined by a function of two beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU is "the degree to which a person believes that using a particular system would enhance his or her job performance" while PEOU is "the

degree to which a person believes that using a particular system would be free from effort" (Davis 1989). PU and PEOU create belief among potential users and subsequently form their attitude. A user that believes the new technology will be useful and relatively easier to implement may be expected to have a more positive attitude towards that particular technology.

Based on the work of Davis (1989), PEOU has a direct effect on PU. Between two systems that perform an identical set of functions, users find the one that is easier to use more useful. However, PU has no impact on PEOU. As Davis (1993) explains, PU concerns the expected overall impact of system use on job performance, whereas ease of use pertains only to those performance impacts related to the process of using the systems per se.

2.4. Research hypotheses

Based on Davis´s model (1989), the accepted TAM hypotheses were tested as part of this study and we propose the following set of hypotheses, relevant for the understanding of the role of ICT in facilitating citizen engagement with public services in the context of this research:

H1: Perceived ease of use is positively associated with perceived usefulness

H2: Perceived usefulness is positively associated with attitude

H3: Perceived ease of use is positively associated with attitude

Uses and gratification theory predicts that a proactive attitude encourages people to recognise and meet the learning needs of Internet or other media (Althaus and

Tewksbury, 2000), and thus create t-knowledge (Herschbach, 1995). It is suggested in the research literature that users with a more positive attitude towards a technology are more likely to learn and retain new knowledge (e.g., Guimaraes and Igbaria, 1997; Chris *et al.,* 2006; Eastman *et al*., 2011). A possible explanation would be the fact that a positive attitude lets users relax, remember, focus and absorb knowledge as they learn (Vincenti, 1984; Davis *et al*., 2009; Cegarra *et al*., 2011). These considerations lead us to argue that for citizens to learn about local government websites, it is necessary for local authorities to foster in users (citizens) positive attitudes towards learning about ICT (Davis, 1989). As Martinez-Caro *et al*. (2012) noted, without positive attitudes and perceptions, citizens have little chance of learning about ICT and learning to use ICT. Thus, the learning of t-knowledge starts with having a positive attitude towards ICT and the hypothesis we propose under this framework is:

H4: A positive attitude towards a technology is positively associated with t-knowledge

As described above, local government websites may provide new venues for information, enhancing citizen t-knowledge of government policies, processes, programs, and performance, as well as community issues (Norris 2001; Wang, 2007). In addition, t-knowledge about community affairs available on local government websites might promote discussion and mobilization around these issues with neighbours, both online and offline (Norris, 2001). That might mean, then, that t-knowledge may encourage discussion or participation in community issues, including joining a group online and face-to-face interaction with neighbours (Norris, 2001). For example, t-knowledge about city council websites cannot only simplify online transactions (Norris

2001; Jennings and Zeitner 2003; Mossberger *et al*., 2008), but it can also help citizens to get online and learn about issues that are important to local communities (e.g. local regulatory processes and fees). These considerations lead to the argument that t-knowledge achieved through local government websites could be expected to facilitate citizen engagement as well. Therefore, we propose:

H5: T-knowledge is positively associated to citizen's engagement

Figure 1 provides a synopsis of these arguments. Two groups of hypotheses arise: (1) hypotheses for the relations between the TAM variables as in the original TAM framework; and (2) hypotheses between t-knowledge and citizen engagement. Figure 2 shows the sequential model which illustrates the proposed hypotheses. While the first three hypotheses (H1, H2 and H3) portray attitudes towards technologies as socially constructed through interaction between perceived usefulness and perceived ease of use (i.e., TAM framework), the last two hypotheses (H4 and H5) provide a perspective where a positive attitude towards technologies is likely to lead to an improvement in t-knowledge and also potentially facilitate the citizen engagement.

<Figure 1>

3. Method

Data collection

A sample was drawn from the records of Cartagena City Hall users, who were reported to have used "the Benefits Advisor tool" between January 1, 2011, and December 31, 2011. Cartagena is a Spanish city and a major naval station located in the Region of Murcia, by the Mediterranean coast, south-eastern Spain. As of January 2013, it has a population of 218,244 (CPAN, 2013). Cartagena is Murcia's second largest municipality and the country's sixth-largest non-Province capital city. It should be noted that the City Council was involved in the process of implementing the Benefits Advisor tool which is an interactive tool to apply for a census certificate and to pay for local taxes such as the motor vehicle tax and the property tax. This tool also helps users see how their payment is being processed. The Benefits Advisor tool can give citizens easy remote access to information that would otherwise require contact with the City Hall's staff. Therefore, the data collected and analysed as a result of this research help understand a process whereby an extended Technology Acceptance Model potentially influences the successful utilisation of the Benefit Advisor tool.

Using the records of the Cartagena City Council, we considered 1995 users, who were contacted and asked by the City Council to participate in the study. Of these users, only 307 agreed. Then, during April and May, 2012, we conducted 307 telephone interviews with users using a simple structured questionnaire. Therefore, the data analysis was based on 307 valid responses (a response rate of 15.38%) with a factor of error of 5.15% for p=q=50% and a reliability level of 95% per cent. The large majority of respondents

were male (73%) and had studied at university (37%). Additionally, two statistical analyses were conducted to ensure the absence of non-response bias (Armstrong and Overton, 1977). Firstly, the responding and non-responding users in terms of level of education (1 = secondary school; 2 = Bachelor's Degree; and 3 = Master's Degree) were compared and the independent sample *t*-test revealed no significant difference between the two groups (p= .93). Secondly, the respondents were divided into two groups based on telephone interview dates (i.e., 1 = April; and 2 = May). Comparison of the two groups in terms of e-government use again revealed no significant differences based on the independent sample t-test (p = *.71*). Therefore, non-response bias was not considered to be a problem in this study.

Measures

Before undertaking the survey, a series of telephone interviews with a pilot sample of five users was undertaken to learn about their understanding about the Benefit Advisor tool. These users stated that the Benefit Advisor tool basically promotes electronic tax revenue collection. They also stated that the benefit advisor tool helped local authorities to improve tax policies and detect non-declared taxes. They also stated that the benefit advisor tool is also useful for assisting taxpayers.

A questionnaire was developed to be the instrument for data collection. All items were measured using a seven-point Likert-type scale with anchors from "Strongly disagree" to "Strongly agree". Scales were combined from several other relevant empirical studies with new items to make an initial list of 15 items (3 measuring the range of PEOU; 3

measuring the existence of PU, 3 measuring attitude, 3 measuring t-knowledge satisfaction and 3 relating to citizen engagement). Several items were modified through interviews with colleagues. Table 1 provides an overview of the final 15 questions used in the questionnaire.

Insert Table 1 about here

As noted above, the information about PEOU, PU and attitude was collected through a simple structured questionnaire. Studies on perceived usefulness, perceived ease of use, and attitude toward the adoption have been well researched, especially in the context of TAM applications. Measures for these constructs have also been developed, validated, and adopted in many technology adoption studies (Chau and Lai, 2003). In this paper, the items used to measure perceived usefulness, perceived ease of use and attitude were adapted from prior work by Davis (1989). Items were measured using a 7-point Likert scale.

In order to examine technology knowledge, we sought to measure the dimensions that have been defined for technology slack (Szulanski, 1996; Sharma, 2000; and Nohria and Gulati, 1996). Items were measured using a 7-point Likert scale. Technology knowledge consists of three items.

In order to ensure that the research can be generalised, it is important to add control variables to the regression model so that the effects of technology on our population sample achievement are independent of the user's focus on their achievement. With

respect to this issue, the findings of traditional sociological studies point to more positive attitudes towards computer technology among males (e.g., Savage, 1987 Arch and Cummins, 1989). Specifically, some empirical evidence suggests perceived usefulness more salient for men than for women (e.g., Venkatesh and Morris, 2000) while other researchers find that technologies are perceived as more useful by women than by men (e.g., Gefen and Straub, 1997). Thus, the responder's gender may be related to the perceived usefulness. In this paper, the variable "gender" has been treated as a control variable and was measured with a single variable classified into two categories (1=male and 2= female).

Validation of measures

In order to obtain a robust evaluation of the quality of the sixteen items (see Table 1), a confirmatory factor analysis (CFA) was achieved using the covariance matrix as input via the EQS 6.1 robust maximum likelihood method (Bentler, 1988). This can be justified since maximum likelihood (ML) and generalised least squares (GLS) estimators are based on use of normal data, and if the data are not normal, the χ^2 goodness-of-fit test using these estimators can reject too many true models and produce biased parameter estimates (West *et al*., 1995). Therefore, the robust maximum likelihood (RML) method was used to estimate parameters for this model and fit indices that are less sensitive to non-normal data (Satorra-Bentler χ^2, CFI and IFI) were used to interpret the model fit (Olsson *et al*., 2000).

An examination of the results shown in Table 2 suggests that all of the constructs are reliable. For all the measures, Bagozzi and Yi's (1988) composite reliability index and Fornell and Larcker's (1981) average variance extracted index are higher than the evaluation criteria of 0.7 for composite reliability and 0.5 for the average variance extracted. In addition, the CFA produced a good fit with an incremental fit index (IFI) of .94, a goodness-of-fit Index (GFI) of .90 and a comparative fit index (CFI) of .93 (also, $\chi^2_{(79)}$=176.40; χ^2/d.f=2.23; and RMSEA=.063). The fit index of RMSEA is below 0.08, and indices of CFI, GFI and IFI are above the common standard of 0.9 (Hair *et al*., 1998). Although a significant chi-square value indicates that the model is an inadequate fit, the sensitivity to sample size of this test confounds this finding, and makes rejection of the model inappropriate on the basis of evidence alone (Bagozzi, 1980). However, a ratio of less than three (χ^2/df<3) indicates a good fit for the hypothesised model (Carmines and McIver, 1981).

Insert Table 2 about here

Discriminant validity was determined by comparing the square root of the average variance extracted (i.e., the diagonals in Table 3) with the correlations among constructs (i.e., the lower triangle of the matrix in Table 3). On average, each construct related more strongly to its own measures than to others (Fornell and Larcker, 1981). The constructs' correlation matrix, shared variances, means and standard deviations are shown in Table 3.

Insert Table 3 about here

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4. Results

Once the psychometric properties of the measures had been checked, the next step was the evaluation of the hypotheses developed from consideration of the relevant literature. Following the recommendations of Anderson and Gerbing (1988), we tested our theoretical model (TM), with 't-knowledge' as intermediate variables between 'attitude' and 'citizen engagement', against an alternative model (AL), considering that 't-knowledge' does not need to be done first. Figure 2 provides a synopsis of these models. While in the first model (Theoretical Model) the impacts of 'attitude' on 'citizen engagement' is potentially mitigated by the extent to which t-knowledge exists, in the case of the Alternative Model, the impact of the 'attitude' is not mediated through the extent to which t-knowledge exists. The goodness of fit indices show that the theoretical model has more adequate fit indices: RMSEA, CFI, IFI and PNFI (see Figure 2), than the alternative model. It is interesting to note that the difference of PNFI (James *et al*., 1982) between the two models is above 0.01, a critical value recommended by Hair *et al*. (1998) as indicating that one model represents a significant gain of parsimony over another. In the Alternative Model, we have also found an insignificant effect of 'attitude' on 'citizen engagement', with a standardised coefficient of 0.09. Furthermore, the theoretical model explains more variance in citizen engagement than the alternative model. Therefore, the data obtained provides support for the theoretical model where the extent to which t-knowledge exists is considered as a mediating variable between 'attitude' and 'citizen engagement'.

With regard to the theoretical model, the fit is satisfactory (χ^2/d.f=2.09; CFI=.93; IFI=.93; PNPI=.79; and RMSEA=.060). The results of the hypothesis tests are also shown in Figure 2, referred to in the text as H1, H2, H3, H4 and H5. By testing our hypotheses, Figure 2 shows that in all cases the relationships are highly significant and the structural model explains 74 percent of the variance in citizen engagement. It is also interesting to note that the PNFI is above the common standard of 0.6 (James *et al*., 1982), thereby suggesting that the nomological network of relationships fits our data which is another indicator of support for the validity of these scales (Churchill, 1979). Together, these results provide full support for H1, H2, H3, H4 and H5. In addition, responder gender was insignificant with a standardized coefficient of (β_{21}=0.08) and therefore gender does not affect the perceived usefulness (see Figure 2). Therefore, our results did not indicate any significant effect of gender on perceived usefulness. Although there was a positive correlation in Table 2 it was not significant. It would appear that neither females nor males favour or appreciate the benefits of technology.

<Figure 2>

5. Discussion

The first contribution of this research is to extend the basic TAM by adding the consequent variables of t-knowledge and citizen engagement. While many researchers have extended the basic TAM by introducing additional variables there are surprisingly few, if any, studies on t-knowledge and citizen engagement. In this regard, modelling local government website acceptance is very useful to local institutions but understanding whether t-knowledge has an effect on citizen engagement is crucial. The

research model tested provides deeper insights into the process of accumulating citizen engagement. T-knowledge was included in the model to act as a link between TAM variables and citizen engagement and the results indicate that a positive attitude towards e-government services leads to users' t-knowledge. Hence, it is very important to work towards achievement of the highest positive attitude in users by enhancing ease of use and, mainly, perceived usefulness.

The second contribution of this research derives from the results of the empirical test of the hypotheses. The managerial implications of the relationships observed between the factors that constitute the hypothesised relationships are discussed in more detail in below.

Our results give full support for hypotheses H1, H2 and H3, indicating that the TAM constructs (perceived usefulness, ease of use and attitude) significantly affect user t-knowledge, which implies that the main aspects of TAM apply to this context as well. Both perceived ease of use and perceived usefulness were found to have a strong effect on attitude towards e-government services. This means that in order for a citizen to use the city council's website in a productive manner, the usefulness and the ease of use of the city council's website should be both taken into consideration. In addition, perceived usefulness was found to be the most significant effect on attitude which is consistent with earlier research that found that perceived usefulness plays a more significant and stronger role than perceived ease of use on the affective variables (Roca *et al*., 2006). Therefore, this paper is supportive of previous studies that demonstrate the

identifying the value of TAM in the implementation of electronic services (e.g. Davis, 1989; Kim and Chang, 2007; Suki and Ramayah, 2011).

With regard to H4, results support a positive relationship between attitude and t-knowledge. This insight corroborates the notions of Suki and Ramayah (2011) that the acceptance of electronic services (e-services) can be explained in terms of attitude towards ICT. As explained by Davis (1989), attitude is the degree to which the user is interested in specific systems. What this means for local government websites is that public administrators should be aware of the fact that citizens are sometimes unaware of the ways in which ICT can benefit them or what e-services are available for them to use (Zajicek, 2006). If this is the case then public administrators may be overinvesting in the implementation of ICT and underinvesting in (or underestimating) the mechanisms and aspects to improve t-knowledge. As Hartwick and Barki (1994) point out, in order to facilitate the provision of e-services involving the completion of online forms or transactions, vaguely formed attitudes concerning the system to be implemented should be taken into account. By failing to do so, implementation may prove unsuccessful and more resources may be spent than saved (Lanseng and Andreassen, 2007).

With respect to H5, the results also support the position that through the t-knowledge of citizens, City Halls will enlarge citizen engagement. These findings support the view of Carter and Belanger (2005) that perceived usefulness has positive and significant effects on a citizen's continual usage intentions towards e-services. If the utility of local government websites is understood (i.e. t-knowledge), then mechanisms can be developed for helping citizens to engage more in issues that are important to local

communities. What this means for public administrators, is that it is necessary to evaluate t-knowledge of users to enhance the chances of variety of new technology implementation and further implementation efforts. In doing so, e-services should be pre-tested thoroughly and sufficiently across a wide range of users to see if they actually have been designed to be easy to use by the average user.

The third contribution of this research is to test the TAM in a citizen context. Previous research on the TAM has mainly been conducted in workplace settings and, in particular, within regional and national contexts (Criado and Ramilo, 2003; Carter and Belanger, 2005; Badri and Alshare, 2008; Lean *et al*., 2009). In this type of environment, people's attitudes, intentions, and behaviours, as well as their interrelationships are likely to be shaped by formal authority and directives (Lanseng and Andreassen 2007). This research has empirically supported the core concepts of TAM in a citizen context, where respondents are free to form their own beliefs, attitudes, and intentions, as the theoretical foundation of the TAM assumes. Thus, the results contribute to the general validity of the model.

This study has some limitations. Firstly, the research is based on self-reports and we have used technology users to study technology acceptance, which can bias findings. Secondly, although the constructs have been defined as precisely as possible by reference to the literature and validated by practitioners, they can realistically only be regarded as proxies for underlying phenomena that in themselves are not fully measurable. In the third place, only a single research methodology was employed and further research through interviews and observational case studies could be undertaken

for triangulation of the results. Fourthly, any extrapolation of the conclusions might not be generalisable beyond the sample frame and should be addressed by cross-sector and cross-cultural studies. Finally, we assumed that use of e-government was similar for different actors and participants, and that therefore their assessment could be done in the same way as evaluating electronic online services. In other words we do not include the possibility of actors and participants being able to consider alternative uses of services available to them. Therefore, this assumption should be reviewed and explored further and might involve actors and participants whose concerns and interests might differ from ours.

6. Conclusions

This study adds to the existing literature on TAM applications by including t-knowledge and citizen engagement. This paper has reported an investigation into the relative importance and significance of perceived usefulness, perceived ease of use and attitude on the creation of t-knowledge and citizen engagement through an empirical investigation of 307 citizens who used the benefits advisor tool. The results suggest that, in order to foster citizen engagement, local governments need to support t-knowledge as a prior step to a relevant technology-related initiative. For public administrators responsible for local government websites design, it is worth taking note that t-knowledge is a key factor supporting citizen engagement. This insight corroborates the notions of Ajzen (1991), that behavioural intention is considered to have a direct influence on technology adoption. Furthermore, our results also indicate that citizens't-

knowledge requires a different set of processes whereby local government websites can increase citizen engagement.

The above considerations also imply that in practice, there is a need for the local government to understand the citizens' perceptions and the factors influencing their prior t-knowledge (Venkatesh *et al*., 2008). We consider this to be an important finding because, in response to the general economic situation, many public administrators are cutting back on technology adoption programs by simply publishing information and assuming that it will be of value to citizens, without implementing other forms of citizen engagement. If this is the case then our research can help public administrators to select the most appropriate programs for increasing t-knowledge. For example, in less well-established e-services public administrators should invest more resources in upgrading citizens' attitudes towards ICT. Meanwhile, in more established e-services, public administrators should focus their attention on ICT that are closely related to citizens prior t-knowledge through programs in a variety of forms, from formal education and training where feasible to more innovative initiatives such as those seeking to bridge the generation gap in ICT use.

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Figure 1: Research Model

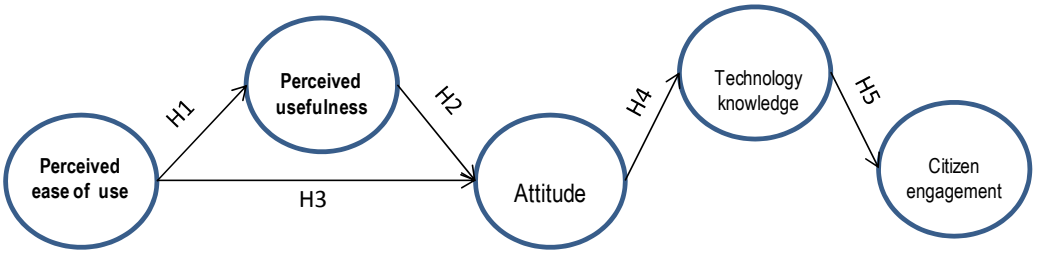
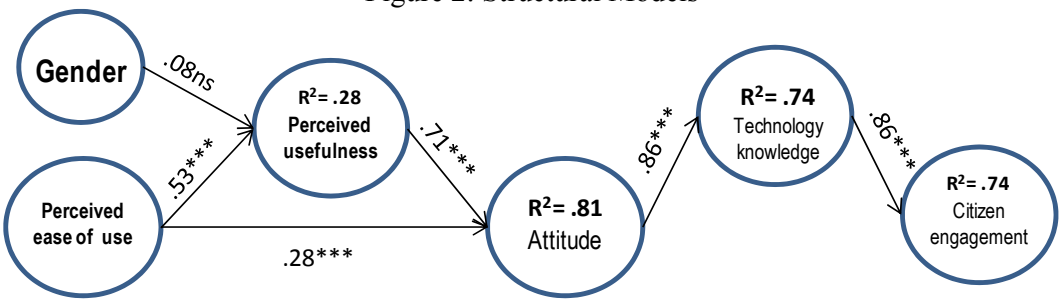
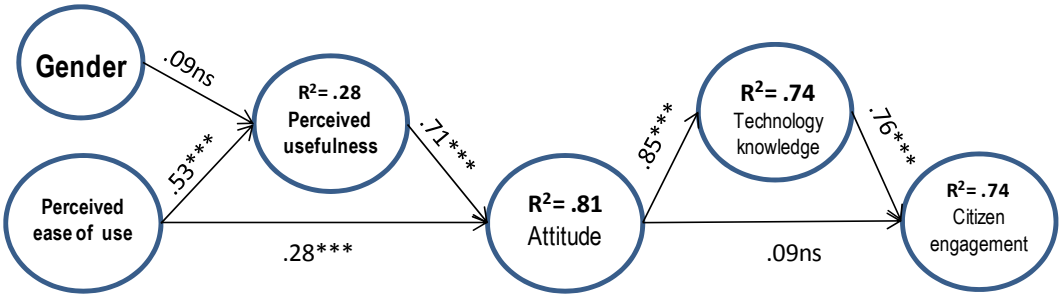


Figure 2: Structural Models



Theoretical Model (TM): χ^2/d.f= 2.09; CFI=.93; IFI=.93; PNPI= .79; and RMSEA=.060



Alternative Model (AM): χ^2/d.f= 2.47; CFI=.92; IFI=.92; PNPI= .78; and RMSEA=.069

Notes:
*** $p < 0.01$
ns=not significant

Table 1: Summary of scale items

Construct	Measure
Perceived usefulness	
USE1	Services enhance effectiveness in doing things.
USE2	Services make it easier to do things.
USE3	Services enable me to accomplish thongs more quickly.
Attitude	
ATT1	In my opinion, it is desirable to use the city council's website.
ATT2	I think it is good for me to use the city council's website.
ATT3	Overall, my attitude toward the city council's website is favourable.
T-Knowledge	
TK1	You have acquired new and relevant technological knowledge.
TK2	You have acquired critical technical skills and abilities.
TK3	Your outcomes have been influenced by new incoming technological knowledge.
Citizen engagement	
CE1	Public meeting in which there is a discussion of town affairs
CE2	Public meeting in which there is a discussion of school affairs
CE3	Citizen consensus conferences on critical street design issues
Perceived ease of use	
PEOU1	Interacting with the city council's website does not require a lot of my mental effort
PEOU2	I find the city council's website to be easy to use.
PEOU3	I find it easy to get the services to do what I want to do.
Gender	1=male and 2= female

Table 2: Construct summary: confirmatory factor analysis and scale reliability

Constructs	Items	Standardized loading	T-value	Reliability (SCR[a]., AVE[b])
PU (Perceived usefulness)	USE1	.76	13.81	SCR= .84
	USE2	.84	14.12	AVE=.63
	USE3	.81	14.39	
ATT (Attitude)	ATT1	.82	14.96	SCR=.84
	ATT2	.78	12.42	AVE=.64
	ATT3	.80	13.96	
T-Knowledge	TK1	.73	13.21	SCR= .85
	TK2	.80	14.88	AVE=.65
	TK3	.77	12.88	
Citizen engagement	CE1	.81	13.41	SCR= .85
	CE2	.75	13.64	AVE=.66
	CE3	.70	10.85	
PEOU (Perceived ease of use)	PEOU1	.73	16.63	SCR=.84
	PEOU2	.88	20.87	AVE=.64
	PEOU3	.77	16.59	

Notes:
The fit statistics for the measurement model were:
Satorra-Bentler $\chi^2_{(79)}$=176.40; χ^2/d.f= 2.23; GFI=.90; CFI=.93; IFI=.94; RMSEA= .063;
[a] SCR= Scale Composite Reliability (SCR) of $p_c= (\Sigma\lambda_i)^2$ var (ξ) / $[(\Sigma\lambda_i)^2$ var $(\xi) +\Sigma\ \theta_{ii}]$
[b]Average variance extracted (AVE) of $p_c= (\sum\lambda i2$ var $(\xi))/[\sum\lambda i2$ var $(\xi) + \sum\theta ii]$
The asymptotic covariance matrices were generated to obtain the scaled chi-square (Satorra and Bentler, 1988) and robust estimation of standard errors.

Table 3: Construct correlation matrix

				Correlation matrix					
	Mean	**S.D**	**CA**	**1**	**2**	**3**	**4**	**5**	**6**
1. Perceived usefulness (range 1–7)	5.03	1.09	.84	***.79***					
2. Attitude (range 1–7)	5.32	1.14	.84	.71***	***.80***				
3. T-Knowledge (range 1–7)	4.77	1.04	.81	.66***	.66***	***.83***			
4. Citizen engagement (range 1–7)	5.26	1.10	.80	.52***	.62***	.67***	***.81***		
5. Perceived ease of use (range 1–7)	4.72	1.22	.83	.46***	.56***	.54***	.34***	***.80***	
6. Gender (range 1–2)	1.27	0.44	n.a	-.04	-.06	-.02	.02	-.07	***n.a***

Notes:

*** <.01; n.a. = not applicable

Mean = the average score for all of the items included in this measure; S.D. = Standard Deviation; CA = Cronbach's Alpha;

Intercorrelations are presented in the lower and shady triangle of the matrix. The bold numbers on the diagonal are the square root of the Average Variance Extracted.