Establishing the relationship between quality dimensions of digital public services and digital technology acceptance using regression analysis among rural population

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Abstract— Public and Private establishments from all over the world are trying to increase their digital technology usage in order to provide better and efficient services to the community. Technological advancements should benefit the vulnerable groups so that they would be able to access public services for their day- to-day needs. To address this issue, this study investigates the acceptance of Digital Services Desk (DSD) which can provide Digital Public Services (DPS) for the digitally excluded group. The analysis sample was collected aiming at understanding the behaviour of the rural respondents on their acceptance of DPS. In total, 400 individual were surveyed and after screening, cleaning and conditioning the data, 375 responses are retained. Regression Analysis along with hypothesis testing, finally interpreted that all the quality dimensions of DPS has significant relationship with Digital Technology Acceptance.

Index terms — Digital Technology Acceptance, Digital Public Services, Digital Services Desk, Regression, Social Innovation

I. INTRODUCTION

The Digital Technology Innovation System is a notion developed within the scientific field of innovation studies which helps to explain the nature and rate of technological changes. A Technological Innovation System can be well-defined as a 'dynamic network of agents interacting in a specific economic/industrial area under a specific institutional infrastructure and involved in the generation, diffusion, and utilization of technology'. The method may be applied to at least three levels of analysis: to a technology in the sense of a knowledge field, to a product or an object, or to a set of related products and artefacts aimed at satisfying a particular (societal) function. With respect to the latter, the approach has especially proven itself in explaining why and how sustainable technologies have developed and diffused into a society, or have failed to do so. Digital innovation is defined as the carrying out of new combinations of digital and physical components to produce novel products. The term digital innovation thus implies a focus on product innovation, distinguishing it from IT innovation research that has been primarily occupied with process innovation (Swanson 1994). A necessary but insufficient condition for digital innovation is that the new combination relies on digitization, i.e., the encoding of analogue information into digital format. Digitization makes physical products programmable, addressable, sensible, communicable, memorable, traceable, and associable (Yoo 2010).

Digital innovation furthermore requires a firm to revisit its organizing logic and its use of corporate IT infrastructures to make the work to be done in an easier way. Whereas, Computer Literacy caused major apprehension to many individuals, accepting the fact that most of the things we do today is computer aided. In order to enhance the computer aided information technology in rural areas Digital Services Desk (DSD) operating in few services Centres would help peoples in rural areas to easily access the digital technology. Thus, this study is about the acceptance of digital technology on using DSDs for accessing Digital Public Services (DPS) in rural areas using the Technology Acceptance Model. The low-income, low levels of digital literacy, elderly and those living in rural communities may have access or technical barriers of accessing data, and DPS should not be another thing that they are excluded from.

SOCIAL INNOVATION AND DIGITAL TECHNOLOGY

'Digital Technology in Social Innovation' is the use of ICT as online networks and other digital tools to support and/or enable social innovation. By 'support' it is meant that a specific social innovation is taking place anyway but that it is, in some way or other, significantly improved by deploying ICT. By 'enable' it is meant to imply that a specific social innovation would not happen without ICT, and could even lead to completely new types of social innovation appearing. It defines social innovation as new approaches to meeting social needs which are both social in their means and in their ends, and which engage and mobilise the beneficiaries and help to transform social relations by improving beneficiaries' access to power and resources (Tepsie, 2012 deliverable D1.4 for a full exposition of this definition of social innovation). It includes in its approach social innovations which use digital tools alongside traditional tools and approaches, so that, for example, it is not assumed that final users and beneficiaries necessarily themselves use digital tools, but that such tools are used in significant ways by one or more actors, or in one or more parts of the value chain, to support or enable social innovation.

DSD provide access to public services for the rural community and data is available through this Digital Technology which can also be transformational and open new perspectives on social innovation, such as the use of so-called 'big data' to collect and analyse data of what social needs are being experienced by many people in different places at different times. DSDs are a Social Innovation for providing DPS to the rural community and the study measures whether it has helped them or not and if they would accept the new digital technology. This paper establishes the relationship between the quality dimensions of DPS offered through DSDs and the influences on the acceptance digital technology by the rural people.

II. THEORITICAL FRAMEWORK

Literature provides a considerable amount of academic research examining the determinants of IT adoption and utilization among users (Venkatesh, 2000; Hsu and Chiu, 2004). Theory of planned behaviour (TPB) and Technology acceptance model (TAM) are among these models that have gained attention and confirmation in a wide array of areas and applications to understand end-user's intention to use new technology and systems (Armitage and Conner, 2001; Venkatesh and Davis, 2000). However, TPB and TAM were developed as an extension to Ajzen and Fishbein's (1980) theory of reasoned action (TRA). TRA is conceived as a general structure designed to explain almost all human behaviour and is based on the importance of an individual's beliefs for the prediction of his/her behaviour (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). According to TRA, behavioural intention to exhibit a particular behaviour is formed based on the individual's attitude toward the behaviour and on perceived subjective norm (SN). The first determinant, attitude toward behaviour, reflects a person's beliefs that the behaviour leads to certain outcomes and the person's evaluation of those outcomes, favourable or unfavourable. The more positive the attitude, the stronger the behavioural intention and, ultimately, the higher the probability of a corresponding behaviour should be.

The second determinant is SN, which captures individual's perceptions of the extent to which his social environment (e.g. family, friends, co-workers, authority figure or media) influences such a behaviour to be normal and desirable. The more strongly this pressure is experienced, the greater the behavioural intention and, indirectly, the probability that the behaviour will be realized. Ajzen (1987, 1991) and Ajzen and Madden (1986) developed the TRA further into TPB by adding new determinant of behavioural intention, perceived behavioural control, which is based on Bandura's concept of self-efficacy. Perceived behavioural control assesses the degree to which people perceive that they actually have control over enacting the behaviour of interest. It is suggested that individuals are more likely to engage in behaviours they feel to have control over and are prevented from carrying out behaviours over which they feel to have no control. As a result, a person who does believe himself capable of certain behaviour will exhibit correspondingly a behavioural intention to exhibit a particular behaviour.

According to TPB, the more favourable the attitude and subjective norms (SN) with respect to a behaviour, and the greater the perceived behavioural control, the stronger should be an individual's intention to perform the behaviour under consideration (Ajzen, 1987, 1991) (Figure 1). Most empirical applications of the TPB try to explain or predict newly introduced behaviour (Armitage and Connor, 2001). The second theoretical grounding for this research is derived from the TAM, which is initially developed by Davis (1989) and Davis et al. (1989) as an extension of Ajzen and Fishbein's TRA to explain and predict particularly IT usage behaviour across a wide range of technologies and user populations. TAM has received much attention from researchers and practitioners as a parsimonious yet powerful model for explaining and predicting usage intention and acceptance behaviour (Yi and Hwang, 2003).

In contrast to TRA and TPB models, TAM focuses exclusively on the analysis of IT (Chau, 1996; Venkatesh, 2000; Mathieson et al., 2001; Childers et al., 2001; Feather man and Pavlov, 2003). However, the topics of TAM research have been varied, including the employment of personal computers in the workplace (Hamner and Qazi, 2009; Moore and Benbasat, 1991; Igbaria et al., 1996), internet use (Lederer et al., 2000); e-commerce (Pavlou, 2003); ERP acceptance (Amoako-Gyampah and Salam, 2004); telemedicine (Hu et al., 1999); internet banking (McKechnie et al., 2006); and mobile banking (Luarn and Lin, 2005). Mathieson et al. (2001) argued that TAM's ability to explain attitude toward using an information system is better than the other multi-attribute models' such as TRA and TPB. Venkatesh and Davis (2000, p. 186) note: TAM consistently explains a extensive part of the variance [typically about 40 percent] in usage intentions and behaviour and that TAM compares favourably with alternative models such as the Theory of Reasoned Action and the Theory of Planned Behaviour. Thus this paper adopts Information Quality, System Quality and Service Quality as Factors for measuring the acceptance of technology in rural areas.

Information Quality:

Information Quality (IQ) has become a critical concern of organizations and this information can promote understanding of some of the key issues relevant to the design and implementation of a viable quality assurance system. IQ is recognized as an essential and competitive strength in every organization and this will improve consumers' provider choices only if it considers the features of care that consumers perceive as relevant to their provider choices. IQ is not an entirely new concept, but it has gained increasing attention during the last few years, both in business communities and higher institution. Much like information, the concept of quality is defined in different ways by different people. The problem of poor data and information quality is widespread and plays a critical role for every organization whose activity is based on communication and information. Insufficient quality of information and data often leads to numerous negative effects; which can disrupt business activities and interfere with decisions or can compromise communication and understanding among people.

According to DeLone and Mclean 1992:60, cited by Gorla, Somers & Wong (2010:213), IQ refers to the quality of outputs the information system produces, which can be in the form of reports or online screens. Huh, Keller, Redman, & Watkins (1990:559) define four dimensions of information quality: accuracy, completeness, consistency, and currency. Accuracy is agreement with an attribute about a real world entity, a value stored in another database, or the result of an arithmetic computation. Completeness is to be defined with respect to some specific application, and it refers to whether all of the data relevant to that application are present. While consistency refers to an absence of conflict between two datasets, currency refers to up-to-date information.

Researchers have used a variety of attributes for information quality. Nelson, Todd, & Wixom (2005: 200) have used the constructs of accuracy, completeness, currency, and format for information quality; the additional construct used by these authors format is related to the presentation layout of information outputs

System Quality:
System Quality (SQ) can be referred to as the system that an organization uses to manage the quality of their services or products. And according to the International Organization for Standardization, defines a quality system as the management system used to direct and control an organization with regard to quality. SQ represents the quality of the information system processing itself, which includes software and data components, and it is a measure of the extent to which the system is technically sound. Seddon (1997:246) espouse that SQ is concerned with whether there are bugs in the system, the consistency of user interface, ease of use, quality of documentation, and sometimes, quality and maintainability of program code. SQ is a series of actions designed to ensure consistency in approach, process and output. The outcome of a quality system is that the organisation has a sound basis for applying the basic philosophy of quality assurance, a clear set of guidelines for quality systems and processes, a means of satisfying contractual obligations, and readily available guidance and direction. SQ is measured by attributes such as ease of use, functionality, reliability, data quality, flexibility, and integration (DeLone et al., 2003:11).

Service Quality:
Service quality (SQ) is crucial to every organisation. Baron, Harris, K., and Hilton (2009) claim that service quality is a highly abstract construct in contrast to goods quality, where technical aspects of quality are evident. According to O'Neill and Palmer (2004:42) service quality in higher education as the difference between what a student expects to receive and his/her perceptions of actual delivery. Clewes (2003:71) is of the opinions that one unresolved issue in the service quality field includes finding an appropriate definition for service quality and a suitable model for measuring service quality. Nevertheless, Lewis and Booms (1983:100) were one of the first to define quality in terms of services, and refer to service quality as a measure of how well the service level delivered matches customer's expectations. A definition of quality revolves around the idea that quality has to be judged on the assessment of the user or employer of the service, and therefore, achieving quality has become an essential goal for most higher education institutions (Abdullah, 2006b:570). According to Jiang, Klein, Tesch and Chen (2003:27) service quality is the comparison between what the clients feel should be offered as their expectation and what is actually delivered according to their perceptions. It was revealed that many researchers are convinced that the service quality for the universities have positively impacted on the student at the higher institution (clients) satisfaction (e.g. Naik et. al., 2010; Spreng et. al, 1996:214; Sureshchandar, Rajendran & Anantharaman 2002:365; Lewicka, 2011:5).

Technology acceptance
In turn, attitude in TAM is influenced by a priori two key elements determining technological behaviour: perceived ease of use (EOU) and perceived usefulness (Davis, 1989; Igbaria et al., 1996). Davis (1989, p. 320) defined perceived usefulness as the degree to which "a person believes that using the system will enhance his or her performance" and EOU as the degree to which "a person believes that using the system will be free of mental effort". According to TAM, perceived usefulness and EOU both affect a person's attitude toward using the system, and consistent with TRA, these attitudes toward using the system determine behavioural intentions, which in turn lead to actual system use.
Whereas both innovation diffusion research and technology acceptance models include a hypothesized relationship between user perceptions and adoption outcomes, the relevance of different characteristics for the two outcomes is moot. There are also conflicting empirical results regarding the saliency of the various perceptions. For example, Moore and Benbasat (1991) showed all of the characteristics' discussed above as relevant to acceptance behavior; the outcome they examined was current usage of the innovation. However, a meta-analysis of innovation characteristics research that reviewed much of the same literature as used by Moore and Benbasat, Tornatzky, and Klein (1982) found only three characteristics-perceived relative advantage, perceived complexity, and perceived compatibility-as being consistently related to adoption behavior. As the evidence regarding the role of the other characteristics included by Moore and Benbasat is limited, it is important to identify which specific characteristics are relevant for each acceptance outcome. In contrast to innovation characteristics research, perceived usefulness and perceived ease of use are the only two characteristics used by TAM to explain acceptance behavior. Thus, to measure the acceptance behaviour of the respondents the items of Digital technology acceptance contain the items related Perceived usefulness, Perceived ease of usefulness and Intent to use to know the appropriate mind set of the respondents towards the acceptance
• Perceived usefulness: the degree to which an individual believes that using a particular system would enhance his or her work.
• Perceived ease of use: the degree to which an individual believes that using a particular system would be free of physical and mental effort

Research hypothesis
H1: There is significance relationship between Information Quality and perceived usefulness
H2: There is significance relationship between Service Quality and perceived usefulness
H3: There is significance relationship between Service Quality and perceived ease of use
H4: There is significance relationship between System Quality and perceived ease of use
H5: There is significance relationship between perceived ease of use and perceived usefulness
H6: There is significance relationship between perceived usefulness and intention to use
H7: There is significance relationship between perceived ease of use and intention to use

III. METHODOLOGY

Sample

The analysis sample collected aimed at understanding the rural respondents behaviour on acceptance of digital technology, which are Digital Public Services (DPS) through Digital Services Desk (DSD) as a form of Social Innovation, which is measured between individuals who are dealing with the DSDs in their areas such as e-Sevai etc. In total, 200 individual were provided the opportunity to take the survey and after screening, cleaning and conditioning the data, 184 individual responses were retained. Such responses provided sufficient data upon which to evaluate data in response to the research questions (Fosnacht et al. 2017; Gagne and Hancock 2006). Individual's in the sample were also diverse by way of gender, race, and major field of education.

Measures

This study has used three independent variable (Information Quality, System Quality and Service Quality, and in TAM, Perceived ease of use and perceived usefulness) and one dependent variable (Intent to use) as seen in Figure.1. These variables were measured using the 5 point Likert scale (1= strongly disagree to 5= strongly agree). Details of the survey instrument measures are discussed below: Information Quality has 3 items scale sample item are "Clearly information we received related to use of technology". The Cronbach alpha for the scale reliability was 0.83. Service Quality has 3 items scale sample item are "People appointed in Digital Services Desk would fulfil the requirements of rural people" The Cronbach alpha for the scale reliability was 0.79. System Quality has 3 items scale sample item are "Technology used in Digital Services Desk satisfy the rural respondents need completely". The Cronbach alpha for the scale reliability is 0.77. Perceived usefulness has 3 items scale with Cronbach alpha for the scale reliability 0.85. Perceived ease of use has 3 items scale with Cronbach alpha 0.91. Intent to use to use has 3 item scale with Cronbach alpha 0.81.

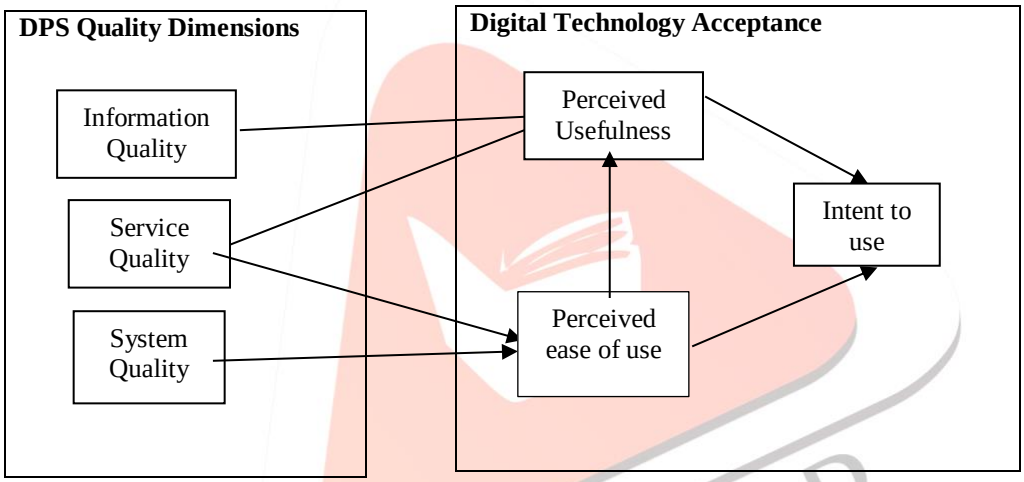

Figure.1 Proposed Model – DPS Quality Dimensions with Digital Technology Acceptanc

IV. RESULTS AND DISCUSSION

Table.1 Karl Pearson Coefficient of Correlation

Variables of Interest	Information Quality	Service quality	System Quality	Perceived ease of use	Perceived usefulness	Intent to Use
Information Quality	1					
Service Quality	.542**	1				
System Quality	.642**	.638**	1			
Perceived ease of use	.541**	.744**	.648**	1		
Perceived usefulness	.566**	.651**	.653**	.623**	1	
Intent to use	0.455**	0.745**	0.453**	0.658**	0.656**	1

Correlation coefficients are significant at *p < .01; and **p < .001

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. Correlation (Pearson, Kendall, Spearman)is a bivariate analysis that measures the strength of association between two variables and the direction of the relationship. A positive correlation value means that the variables concerned increase or decrease in parallel as one increases or decreases so does the other whereas a negative correlation value indicates that as one variable increases the other decreases, or vice versa. Thus, the above Table.1 shows Karl person coefficient of correlation with the reliability

coefficients and correlations among the major study variables. The correlations between the study variables were in the expected direction (positive correlation) and statistically significant.
The correlation analysis reveals that among the quality attributes, the service quality is the most correlated (0.745) with users intention to adopt the DHD facility besides significantly impacting PEOU and PU. Though the system and information quality has lesser association directly with people intention, they seemed to possess a higher correlation with PEOU and PU, thereby proving to be worthy predictor variables.

Test of Multicollinearity:
Multicollinearity is the occurrence of high intercorrelations among independent variables in a multiple regression model. Multicollinearity can lead to skewed or misleading results when a researcher or analyst attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical model. Thus, the above Correlation Table.1 shows that Correlation between two independent variables are lower – Moderate.(0.3 – 0.7). There is no existence of Multicollinearity between the variables. Results are met the underlying Assumptions of Multiple Regression with Normally distributed data. In statistics, the variance inflation factor is the ratio of variance in a model with multiple terms, divided by the variance of a model with one term alone. It quantifies the severity of multicollinearity in a regression analysis. Following Table.2 explains the VIF and Tolerance.

Table 2: Results of Coefficients

Model	Collinearity Statistics	
	Tolerance	VIF
Information Quality	.654	2.279
Service Quality	.795	3.398
System Quality	.572	2.229
Perceived usefulness	.674	2.239
Perceived ease of use	.654	2.435

Figure.2 Normal Distribution of TAM

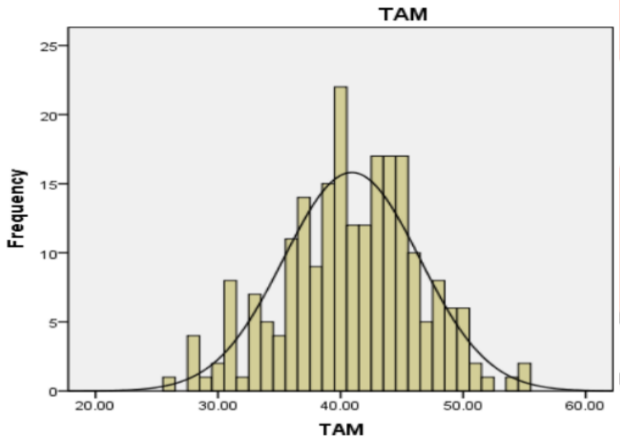

Figure.3 Normal Distribution of Information Quality

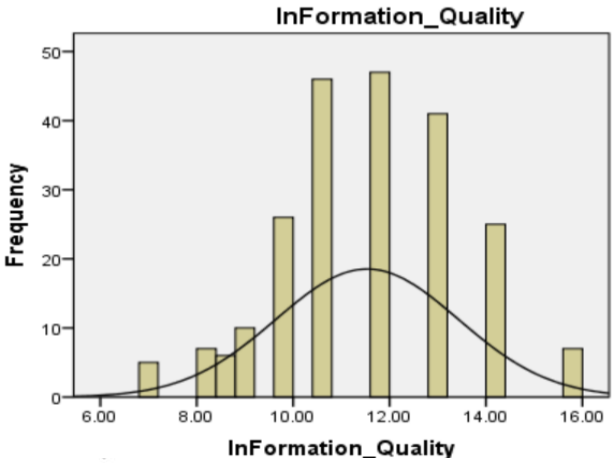

Figure.4 Normal Distribution of Service Quality

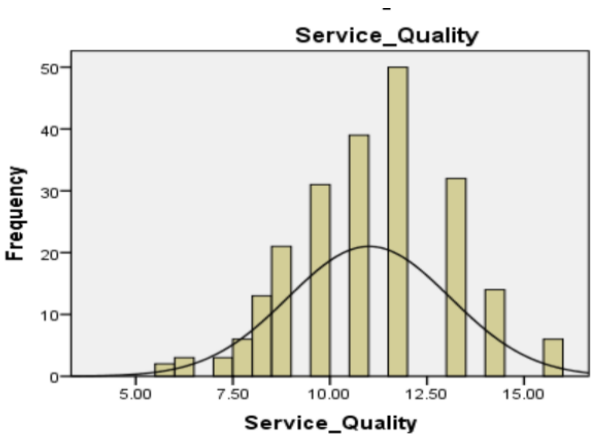

Figure.4 Normal Distribution of System Quality

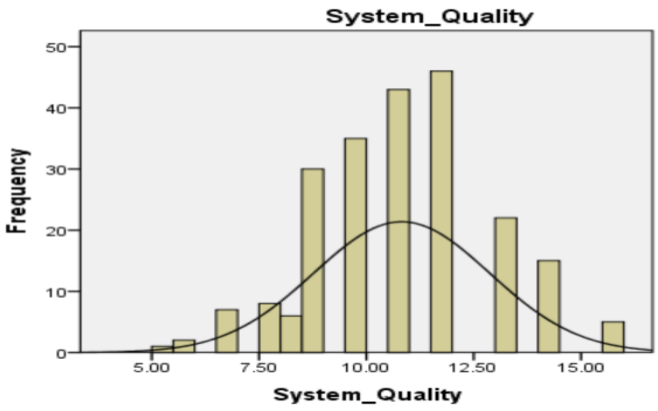

Table.2 Estimated Structural Model – Regression

Relationship	Beta value	T value	Sig	Conclusion
Information Quality ----→Perceived Usefulness	0.513	2.436	.005	H1 Supported
Service Quality --→Perceived Usefulness	0.730	2.986	.001	H2 Supported
Service Quality ----→Perceived ease of use	0.781	2.586	.003	H3 Supported
System Quality --→Perceived ease of use	0.441	2.041	.007	H4 Supported
Ease of use --→ usefulness	0.565	2.461	.001	H5 Supported
Ease of use --→ Intent to use	0.764	2.643	.003	H6 Supported
Usefulness --→ Intent to use	0.562	2.401	.001	H7 Supported
R Square .792	.000			
Adjusted R Square .728				
F 242.960				

The above Table.2 contains the results of multiple regression analysis based on the relationships proposed by the hypothesis. The outcome of the analysis is used to predict the impact of the predictor (independent) variables on intent to use (Criterion). R-squared (R^2)is a statistical measure that represents the proportion of the variance for a dependent variable that's explained by an independent variables in a regression model. It may also be known as the coefficient of determination. Whereas, the adjusted R-squared compares the descriptive power of regression models two or more variables that include a diverse number of independent variables known as a predictor. Every predictor or independent variable, added to a model increases the R-squared value and never decreases it. Comprehensively, the model accounts for 79.2% of the variance in intent to use. Also, the model showed a good fit to the data as evidenced by the Adjusted R Square of 0.728 with significant p value ($p<0.05$).
Service quality (beta = 0.730 P value <0.05) has a greater influence on Perceived Usefulness than Information Quality(beta = 0.513 P value <0.05). Also Service Quality (beta = 0.781 P value <0.05) influences Perceived ease of use more than System Quality (beta = 0.441 P value <0.05). Thus H1, H2, H3 and H4 are supported, which directs that a better service will result in a positive attitude towards ease of use and usefulness of DHD. Perceived Ease of use and Usefulness share a significant relationship (beta = 0.565, $p<0.05$) proving H5 to be true. The users intent to use DHD is found to be influenced more by their attitude of Ease of use (beta = 0.764, $p<0.05$) than by perceived usefulness (beta = 0.562, $p<0.05$), although both H6 and H7 are supported.

V. CONCLUSION

The prime focus of the study is to understand the basic quality dimensions that influence the acceptance of digital technology which enable public services using Digital Service Desk (DSD) as a social innovation among the rural respondents. Based on relevance of the context in the literature, five variables were derived as the predictors of intent to use the Digital Public Services (DPS) facility. The three quality factors namely system quality, information quality and service quality were assumed to influence the TAM variables Perceived Ease of use and Perceived usefulness. These TAM variables that share a mutual relationship, also impacts the intent to use. The hypothesized relationships were tested by regressing the predictors on the criterion variable.
The regression results were consistent with TAM, as a positive perception of Ease of use and usefulness of digital technology enhanced the users intent to use the Digital Public Services (DPS). Ease of use proved to be the strongest predictor than usefulness. This implies the fact that people tend to adopt digital technology provided they believe it is easy to use rather than the purpose it serve (usefulness). The results also revealed that quality of the service plays a vital role than the quality of the technology and the information it provides. To conclude, the study results advocate that Ease of Use backed up by the service quality impacts the users intention to use digital technology in Social Innovation.

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