Task Technology Fit and Lecturers Performance Impacts: The Technology Utilization, Satisfaction and Performance (TUSPEM) Dimension

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Abstract

The number of technologies being developed for handling ICT related tasks is on the increase. However, the salient issues necessitating the preference of one technology to the other, and the high rate of abandonments of technologies after usage call for concern. This paper seeks to use the TUSPEM model as the theoretical framework in the evaluation of end-users performance impacts from the task technology fit, actual technology usage and user satisfaction dimensions. Through a survey instrument, the views of 95 Lecturers at the National Open University of Nigeria were collected and analysed using structural equation modelling - Smart PLS. The result showed a significant relationship between TTF and performance, user satisfaction and performance as well as actual utilization and lecturer's satisfaction. Understanding technology fit and satisfaction derived from actual usage of technologies is critical to organizations and software developers if the sustenance of information systems is anything to go by.

Keywords: *Task Technology fit, user satisfaction, utilization, performance, information system, TUSPEM.*

1. Introduction

The rapid 'turning-in' of innovations in the Information, Communication & Technology (ICT) field is a positive step in the right direction. ICTs have not only impacted greatly in workplaces and institutions, it has made life easier and more productive. In evaluating the impact of ICTs in the different sectors, several studies have continued to evaluate ICTs generally without recourse to the fact that these technologies have varying degrees of complexities in usage. The educational sector is not an exception. It has become increasingly necessary therefore, for educational institutions all over the world to continue to re-evaluate the impacts of the various ICTs as they influence their task requirements. This is particularly important in order to fully maximise the ICT potentials, ensure productivity in workplaces and provide a direction for future growth and development.

The relationship between information technology and user performance is constantly being revisited by information system researchers. Goodhue and Thompson (1995) proposed the task-to-performance chain (TPC) in order to investigate this relationship. This theoretical framework was based on two separate research angles: (a) the user acceptance and adoption research angle that focused on user beliefs and attitudes to predict the utilization of information systems Davis et al., 1989; Fishbein and Ajzen, 1975; Robey, 1979; Swanson, 1987); and (b) the 'fit angle' which focused on the impact of data representation on the performance of individual IT users (Benbasat et al., 1986; Vessey, 1991).

As reported by Irick, M.L. (2008), the limitations of viewing performance from either of these angles alone have been analyzed. Focusing only on the utilization model ignores the fact that not all utilization is voluntary. For example, a system may be used simply because it is all that is available, and the user has no choice but to use that technology. To the extent that utilization is not voluntary, performance impacts will depend increasingly upon task-technology fit rather than utilization (Goodhue & Thompson, 1995). In addition, there is the possibility that increased utilization of a system will not necessarily lead to higher performance, as in Pentland's study of the IRS auditors. There are also limitations with relying strictly on the TTF model. Models focusing on fit alone do not give adequate attention to the fact that systems must be utilized before they can have any impact on performance.

The relationship between TTF and performance has been investigated by previous studies in the past. Goodhue and Thompson (1995) supported the relationship in their study of 25 different technologies in two organizations. In his call, Goodhue (1998) suggested that further conceptual and empirical research to address the issue of whether there is a link, is needed and, under what condition the relationship is strong and weak (p.128). In response to this call, Staples and Seddon (2004) found a strong support for the impacts of TTF on performance in mandatory usage environment, consistent with Goodhue and Thompson (1995) with more explanatory power from TTF. In a related work, Luarn (2009) found moderate support for the linkage that TTF will positively affect the performance of employees to collaborate.

Purpose of the Study

This study seeks to use the TUSPEM model to examine the relationship between task technology fit construct as it affect usage and users' satisfaction of information technologies and performance from the perspective of Nigerian University Lecturers.

2. Literature Review

2.1 Performance Impacts

Performance impact is the accomplishment of a portfolio of tasks by an individual. Performance impact has to do with how well the work is performed or how much value is added/created as a result of using the system. According to Goodhue & Thompson, (1995), the completion of a specific task is directly related to an individual's performance. A higher level of individual performance can suggest improved effectiveness and efficiency. This in turn can result in higher quality output.

2.1.1 The Task-Technology Fit Construct

Task technology fit is regarded as the degree to which a technology assists an individual in performing their portfolio of tasks. TTF is seen to be higher when the functionality of a technology and the user's requirements are similar. Additionally, TTF is lower if the functionality of the technology is less adequate in meeting the needs of the user or when the demands of a task are increased. Individuals have a greater tendency to utilize technology if the capabilities of the technology fit the needs of the individual.

According to Goodhue & Thompson, (1995), the completion of a specific task is directly related to an individual's performance. A higher level of individual performance can suggest improved effectiveness and efficiency. This in turn can result in higher quality output. A high TTF increases both the chances that a technology will be utilized and the user's performance. It has been proposed by Goodhue and Thompson that a high TTF leads to an increase in user performance because the technology has a tendency to have more of a direct fit with the needs of the user.

The level of TTF is based on system evaluations performed by users of a specific technology. These evaluations measure the user's perceptions of the characteristics of a specific technology. These evaluations are usually given on a continuous scale from positive to negative ratings. A positive rating of a technology from a user would indicate that the technology is improving the user's performance, while a negative rating may suggest that the technology is hindering the user's performance (Chandler, 1995).

2.1.2 Satisfaction - DeLone and McLean's Model of IS Success

Satisfaction with an information system is commonly measured as an indicator of information systems success (Hwang & Thorn, 1999) and has been identified as a precursor of performance impacts in DeLone and McLean's (1992) model of IS success.

The concept of the updated model according to DeLone and McLean (2003) consists of six interrelated dimensions of IS success: information, system and service quality, (intention to) use, user satisfaction, and net benefits. The model can be interpreted as follows: A system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction. As a result of using the system, certain benefits will be achieved. The net benefits will (positively or negatively) influence user satisfaction and the further use of the information system.

Rai et al. [2002], in their study to assess the validity of DeLone and McLean's [1992] and Seddon's [1997] IS success models, found that IS user satisfaction impacts IS use: a higher level of satisfaction creates greater user dependence on the system. Their results support the posited impact of IS user satisfaction on IS use, assessed by system dependence, as suggested by the DeLone and McLean [1992] and Seddon [1997] models. This relationship is consistent with Davis' [1989] findings that attributes towards using the system shape system-usage behaviour.

2.1.3 The Technology Utilization, Satisfaction and Performance Model (TUSPEM)

Since the call for the integration of information technology theories and models aimed at understanding the factors influencing IT choices, usage and performance, there has been several attempts by different scholars in the information systems field.

The proposed TUSPEM model by Osang et al (2014) combined constructs such as ease of use and perceived usefulness from TAM, satisfaction from DeLone and McLean (2002), usage, TTF, user habit, attitude and performance from Goodhue and Thompson (1995), and computer self-efficacy from Compeau and Higgins (1995), Eden et al (2010); Aguirre-Urreta, 2011). The model is shown in the diagram below:

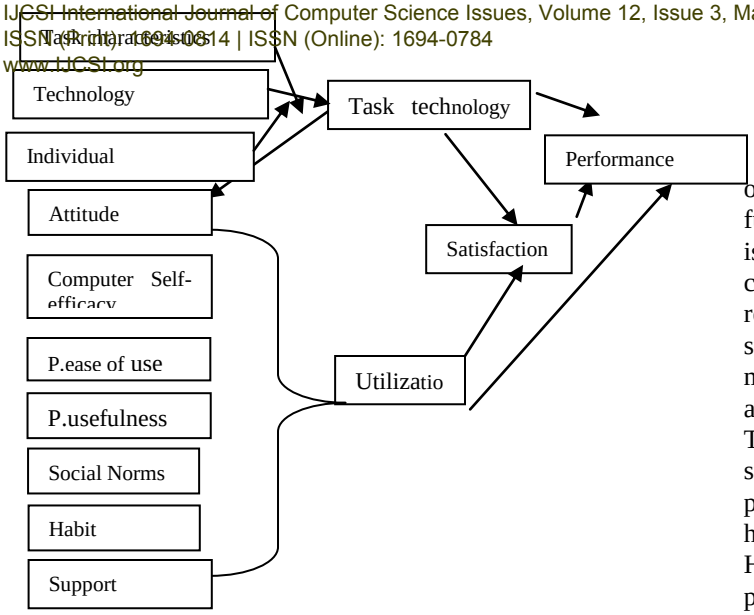

Fig.1 Technology-Utilization-Satisfaction-Performance Model (TUSPEM)

2.2 The Research Model and Hypotheses

In this study, the focus is on the direct path through which TTF affect system utilization of an information system, users' satisfaction and performance as well as the relationship between satisfaction and task performance. Since the focus is on TTF, our model would not include task characteristics, technology characteristics and individual characteristics. As suggested by Goodhue and Thompson (1995), McGill et al (2008), it is sufficient to know a user's evaluation of TTF to examine the influence of TTF on performance impacts. System utilization is also viewed directly from TTF without focusing on its precursors. The model used in this research is showed in figure below:

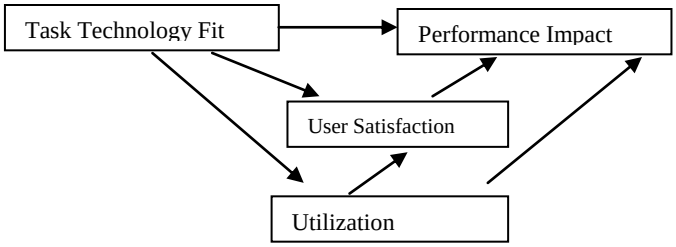

Fig. 2 Research Model

2.2.1 TTF and Performance

The effect of TTF on performance has been attributed to the variance in the degree to which the various technologies are suited for performing the various tasks from the respondent's perspective. As noted by Eden et al 2010, the evaluation of how well a specific technology is suited for the performance of a given task has motivational effects on the users.

The relationship between TTF and performance has been investigated by previous studies in the past. Goodhue and Thompson (1995) supported the relationship in their study of 25 different technologies in two organizations. In his call, Goodhue (1998) suggested that further conceptual and empirical research to address the issue of whether there is a link, is needed and, under what condition the relationship is strong and weak (p.128). In response to this call, Staples and Seddon (2004) found a strong support for the impacts of TTF on performance in mandatory usage environment, consistent with Goodhue and Thompson (1995) with more explanatory power from TTF. In a related work, Luarn (2009) found moderate support for the linkage that TTF will positively affect the performance of employees to collaborate. Hence the hypothesis is framed as follows:

H_1: TTF will positively influence e-assessment performance impacts for Lecturers.

2.2.2 Task Technology Fit and User Satisfaction

The TTF construct has also been identified to influence User satisfaction with a given system. It is argued that when the fit of a technology is high, users will be satisfied with the technology in what Goodhue termed as affect towards use. According to Goodhue (1988), user satisfaction is a fit between personal needs and the benefits of using a system and would be measured by an assessment of how a user feels about a system. In a similar research, Pim Baas (2010) found employee satisfaction as not being consistently found to be related with task-technology fit.

$H_{2:}$ TTF would be positively correlated with user satisfaction

2.2.3 TTF and System Utilization

The relationship between task technology fit and system utilization exist due to the fact that the better the fit, the more the tendency for users to like the system. Goodhue and Thompson tested an indirect link with utilization and found little empirical support between TTF and use. Also Luarn (2009) work on this link moderately supported the linkage that TTF will positively affect utilization directly. On the contrary, several findings have investigated TTF and use through the precursors of utilization. For example, Staples and Seddon (2004), found a positive relationship between TTF and affect towards use implying that users perception of the fit of the system are important influences on their beliefs. Thus, the hypothesis:

H_3: TTF will positively influence information system utilization.

2.2.4 Utilization and Satisfaction

Lee, Kim and Lee (1995) found that system utilization is positively related to end-user IS satisfaction. Similarly, Igbaria and Tan (1997) investigated the impact of end-user satisfaction on utilization. It was found that end-user satisfaction has a positive and significant impact on the utilization. Baroudi et al 1986 also suggested that

end-user satisfaction leads to usage rather than usage stimulating satisfaction.

H_4: Lecturers use of e-assessment technology will influence their satisfaction with the system.

2.2.5 Satisfaction and Performance Outcome

User satisfaction has been defined by Elves et al (1983) as the extent to which users believe the IS available to them meets their requirement. In the TPC model, Goodhue and Thompson (1995) did not find the satisfaction construct as key in determining users' performance. On the contrary, DeLone and McLean (2003), identified six studies out of the sixteen empirical studies that tested the IS success model with a confirmation of a positive and significant relationship between end-user satisfaction and individual performance. Other researchers like McGill et al (2011) have continued to emphasize the need for research into the relationship between users' satisfaction and performance. Hence, the hypothesis is included as follows:

H_5: End-user satisfaction will positively influence performance impacts.

2.2.6 System Utilization and Performance Outcomes

System use has been identified as having a significant and positive effect on individual performance Igbaria and Tan (1997). In the 10-years update of the DeLone and McLean IS success model (2003), seven of their studies confirmed the positive relationship between system use and individual performance impact. Luarn (2009) research work on the relationship between information system use and performance also supported the findings that utilization of IS will positively affect the performance of employees. In the educational sector, McGill (2006) noted that there has been very little research on Lecturers' use of technologies and their resultant outcomes. Most of the studies have identified has concentrated on the students (Hiltz and Turoff, 2005) without much attention to the utilization of information systems by the Lecturers who actually drive the technologies. Hence, a hypothesis was framed thus:

H_6: Utilization will positively influence e-assessment performance impacts for Lecturers.

3. Methodology

The study was conducted at the National Open University of Nigeria. The participants were the Lecturers from all the faculties who are involved in the use of technology for their tutor mark assignment and e-examinations.

Lecturers were first invited to participate in the survey through their official emails by clicking on a link to complete a questionnaire on the web. The questionnaire took approximately 10 minutes to complete. Completion of the questionnaire was voluntary and all responses anonymous. The questionnaire and completion process were pilot tested by six Lecturers and slight changes were made in order to further simplify some items.

The methodology used is the structural equation modelling. Structural equation modelling is a second generation multivariate technique used to analyse or test theoretical relationships among the variables in a model.

PLS-SEM is a causal modeling approach aimed at maximizing the explained variance of the dependent latent constructs. PLS version 3.0 was used for the LVP-analysis in this study due to its validity with significantly smaller sample sizes.

The survey research approach was adopted in order to understand the perception of Lecturers from the National Open University of Nigeria. In order to avoid bias introduced by the researcher's influence on the results, the questionnaire approach was adopted. In this approach, all the participants were asked identical questions in the same order. The response categories from which participants may choose were "closed-ended". The advantage of this inflexibility is that it allows for meaningful comparison of responses across participants and assists in minimizing some level of biases which may characterize his involvement.

The disadvantage of this approach is that it requires a thorough understanding of the important questions to ask, the best way to ask them, and the range of possible responses.

3.1 Sampling

In order to ensure that the views collected through the survey is representative of the Lecturers across the schools within the institution; the stratified random sampling approach was implemented. According to Trochim, (2008, p.4), stratified random approach has the advantage over simple random sampling due to its higher statistical precision than simple random sampling.

120 respondents were selected for the study. Of the 120 selected across the schools for the study, 95 respondents participated actively in the study by returning

the questionnaires. In calculating the minimum sample size required using PLS, the endogenous construct with the most paths leading to it was considered (Performance with three precursors leading into it).

3.2 Instrumentation

The first part of the questionnaire obtained information regarding the respondents' demographic information such as age, gender, level of education and computer literacy level.

Measurement of Demographic Variables

Variable	Measurement
Gender:	Male, female (nominal data)
Age:	Indicated in years by selecting the appropriate range (ordinal data)
Education:	Indicated by indicating education level (ordinal data)
Computer literacy:	Indicated by indicating computer literacy level (ordinal data)
Years using Technology:	Measure by number of semesters using the e-assessment technology.

3.2.1 Development of the Instrument

The second part of the instrument made use of items developed by previous related researchers. All the items were modelled with reflective indicators and measured on a 7 point Likert scale with the end points being "strongly disagree" and "strongly agree". Discrepant cases in the spreadsheet will be assigned -1 for computation.

The diagram below shows the coding used and the number of test items used in the measurement of each of the constructs used in the study.

Performance Outcome	PERF	PERF1...PERF7
Satisfaction	SAT	SAT1….SAT5
Task Technology Fit	TTF	TTF1….TTF8
Utilization	USE	USE1….USE5

Table 1: Showing Construct Codes

3.2.2 Validity and Reliability

The work considered both the outer model and inner models for analysis. The measurement model represents the relationship between the indicators and the LVs. The outer model assessed the model in terms of: Uni-dimensionality, internal consistency reliability, indicator reliability, convergent validity and discriminant validity as discussed under measures above since our model is a reflective model.

3.3 Collection of data

Some questionnaires were printed and distributed to Lecturers who prefer the paper version owing to the bandwidth challenges being encountered in Nigeria and to enable them take their time to respond to the survey. A period of one month was given to the Lecturers to enable them enough time to respond to the instrument. The data was collected by the researcher and recorded in excel (csv) format. Storage of the data was done in both internal and external disk drives to avoid any lost of data after collection.

4.0 Results

A total of 95 Lecturers (Male (63), Female (32)) from the rank of Assistant Lecturer to Full Professor participated in the survey with ages ranging from 25 to 70 years. The participants had a wide range of e-assessment usage experience.

4.1 The Measurement Model

The model was assessed in terms of uni-dimensionality, internal consistency reliability, convergent validity and discriminant validity.

4.1.1 Uni-dimensionality: Two items under the utilization construct did not load sufficiently on the utilization construct with values of 0.18, 0.34, -0.03 and were dropped since the model was a reflective model. All other items loaded significantly on their latent variables. Hence there was high evidence of uni-dimensionality with the other constructs indicator loadings used in the model as all items loaded above the upper threshold of 0.6 Gefen and Straub (2005).

4.1.2 Composite reliability (CR) was used in this study to assess internal consistency reliability. All constructs in the model exceeded the minimum threshold of 0.6 (Nunally and Berstein, 1994) and 0.70 (Hair et al, 2006) except utilization that had 0.51 as shown in table 2 below. Hence, there was also sufficient evidence of internal consistency reliability among the items of the variables in the model.

4.1.3 Convergent reliability was assessed using average variance extracted (AVE). All constructs met the guideline of AVE greater than 0.50 (Hair et al. 2006) except utilization construct as shown in table 2 below.

4.1.4 Discriminant Validity: From the squared AVE values shown in the table 11 above, there was evidence of discriminant validity. Each of the constructs shared more variance with its assigned indicators than with any other variables within the column under it. As a test for discriminant validity, the items should load highest on their targeted construct and have relatively low loadings on all other constructs. In order words, for strong discriminant validity, the diagonal elements must be higher than any other corresponding row or column entry Barclay et al (1995). Consequently, all items loaded highest on their targeted constructs as showed in table 2 below:

Construct	CR	No of items	AVE	1	2	3	4
TTF	0.88	8	0.49	0.70			
Performance	0.89	7	0.54	0.60	0.73		
Satisfaction	0.87	5	0.57	0.42	0.64	0.76	
Utilization	0.51	5	0.25	0.33	0.37	0.41	0.50

Table 2: Measurement model information

4.2 The Structural Model

The evaluation of the structural model involves the use of two criteria: the ability of the model to explain the variance in the dependent variables and the statistical significance of the estimated model coefficients.

4.2.1 The Predictive Ability of the Model

The predictive power of the model for the dataset is represented by the R^2 value on the endogenous variables as shown in figure 3 below.

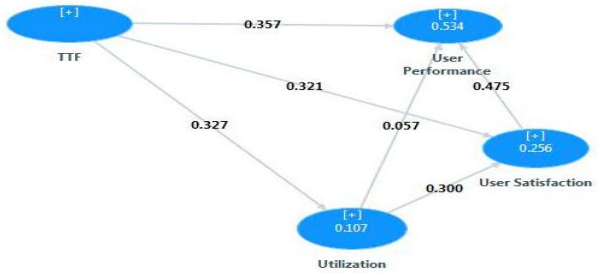

Fig. 3 Structural Equation Modeling

From the figure 3 above, the model predicts 53% of performance impacts, 26% of Lecturers satisfaction, and 11% of utilization constructs. It also implies that 53% of the dependent variable (performance) is explained by TTF, utilization and satisfaction.

It also implies that 47%, 74% and 89% of performance, satisfaction and utilization respectively would be explained by other variables not included in this researched model. The detailed R square values derived from the SEM calculation are showed in table 3 below:

Construct	**R Square Value**
Performance Impact	0.534
User Satisfaction	0.256
Task Technology Fit	-
Utilization	0.107

The table 3 below shows the R Square values of the dependent variables.

4.2.2 The statistical significance of the estimated model coefficients.

The second aspect of the inner model examines the path coefficients of the latent variables used in the model.

Hypothesis	Paths	Path Coefficients	t-value	Support for H_1 ?
H_1	TTF to performance	0.36	2.58	Yes
H_2	TTF to Satisfaction	0.32	2.89	Yes
H_3	TTF to Utilization	0.33	2.21	Yes
H_4	Utilization to Performance	0.06	1.90	No
H_5	Utilization to Satisfaction	0.30	1.51	No
H_6	User Satisfaction to Performance	0.48	3.00	Yes

Table 4: Path Coefficients

4.3 Discussion on Findings

The hypothesized association between TTF and performance impact H_1 was found to be significant. The 36% contribution of the TTF construct to the performance outcome showed a statistically significant relationship between TTF and performance. Goodhue and Thompson (1995) supported the relationship in their studies that analysed 25 different technologies in two of the organizations. Other findings that supported this relationship include Staples and Seddon (2004), Luarn (2008), Eden et al (2010). According to Yuch and Hsu (2008), improvements in TTF of e-assessment usage should lead to a significant improvement in what Lecturers are able to achieve in their e-assessment task. This implies that improvement in the TTF of e-assessment technologies should results to significant improvements in the timely completion of Lecturers' e-assessment task.

The relationship between TTF and user satisfaction (H_2) in this study was found to be significant. This position is supported by Assefa and Prybutok (2006) findings that TTF positively and significantly influences user satisfaction. Although satisfaction was not included in the Goodhue and Thompson (1995), Goodhue (1998) opined that user satisfaction is a fit between personal needs and benefits of using a system and would be most appropriately measured using how a user feels about a particular system.

This study showed that TTF plays an important role in the success of e-assessment for instructors H_3. It considered only a direct influence between TTF and utilization. The hypothesized indirect influence through utilization was not observed. TTF did not influence e-assessment utilization, and furthermore e-assessment utilization did not affect LMS performance impact.

The analysis of H_4 showed that utilization does not directly affect performance impacts of the Lecturers.

This finding is consistent with several studies from literature. For example, in testing the TPC model, Staples and Seddon (2004) did not find any relationship between level of utilization and performance. Equally, as contained in the McGill et al (2011), several researchers using the DeLone and McLean (1992) model of IS success as a framework have pointed out that utilization may not be influenced by system quality and information quality (Liveri, 2005; Landrum et al 2008) and that level of utilization may not influence performance (Wu and Wang, 2006; McGill et al 2003, 2009, 2011;). In fact, according to Seddon (1997), the causal relationship between utilization and individual performance proposed by DeLone and McLean may not exist.

The relationship between utilization and satisfaction H_5 was found to be non-significant. Usage was found to positively and significantly predict satisfaction in this study. This association was supported by the findings of Lee, Kim and Lee (1995). Several studies investigating this relationship supported the path from user satisfaction to system usage suggesting that satisfaction lead to usage rather than usage resulting to satisfaction.

The relationship between end-user satisfaction and lecturer's performance impacts showed a positive and significant connection H_6. The result of this study is different from those obtained from the TPC model by Goodhue and Thompson (1995), Staples and Seddon (2004), McGill et al (2008, 2011). While their results found more explanatory power from the task technology fit than from the utilization angle, this research found 36% explanatory power from utilization compared to the 27% obtained from the TTF construct in their studies.

This is in line with Luarn (2009) findings which indicated that utilization has a greater effect on performance than TTF in a mandatory usage environment.

Apart from the efforts made by Lecturers to get use to the available system in order to complete their e-assessment tasks requirement by Management, the support from the ICT support staff assist Lecturers in the performance of their ICT related task.

Analysis of the structural equation modeling results also revealed 48% contribution of user satisfaction in determining performance impacts compared to 36% contribution of TTF and 6% contribution of utilization.

These findings also suggest that in order to have maximum performance from Lecturers, the technology must not only fit the e-assessment task, their satisfaction while using such system is equally crucial. It implies that educational institutions and organizations should aimed at providing adequate training of staff to enable them fully utilize and appreciate the functionalities and capabilities of the various technologies in their work places.

4.4 Recommendations for Future Research

The relationship between the precursors of utilization such as affect towards use, social norms, users habit, computer self-efficacy, perceived usefulness and ease of use were according to the TUSPEM model was not included in this research. Future research should explore this relationship.

Future research should also explore the applicability of the TUSPEM model in pleasure oriented usage environment as well as at organizational level of analysis.

5. 0 Conclusions

The findings of this study showed that TTF directly affected Lecturers perception of the impacts of e-assessment on their performance. This implies that the better the fit of the technology to the task and the Lecturers skills, the better the effect on their task performance. On the contrary, poor TTF therefore results to delays in completion of assigned e-assessment task, frustrations with the system, poor performance and eventual abandonment of information systems.

It is believed that this research has contributed towards the establishment of the linkage between technology utilization, satisfaction and performance impact in a mandatory IS usage environment. Most of the studies along this dimension have focused on predicting performance only from the TTF and utilization angles. This study however has expanded the scope to include satisfaction as well, as a predictor of performance impact. It therefore means that for performance impacts of an IS to be determined especially in the e-learning domain, the technology must not only fit the task and be used, it should also satisfy the user for better performance.

Another important dimension is the post utilization study of the influence of IS usage on satisfaction. Usage influences satisfaction instead of the pre-usage approach of satisfaction stimulating usage in information systems studies.

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