INFORMATION TECHNOLOGY ACCEPTANCE IN SOUTH AFRICA:A COMPARATIVE STUDY ANALYSIS OF THE PERCEIVED USEFULNESS AND PERCEIVED EASE OF USE CONSTRUCTS

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Abstract

The importance of information for decision-making by executives and managers in organisations has been extensively documented. An Executive Information System (EIS) is a computerised information system (IS), designed to provide managers in organisations with access to internal and external information that is relevant to management activities and decision-making. Information technology (IT) acceptance studies pay much attention to issues of significance in assessing the contributions of variables explaining IT usage for decision-making in organisations. Davis' Technology Acceptance Model (TAM) states that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the two factors that govern the adoption and use of IT. In this paper, discussion is made of the findings of two TAM/EIS studies in the eThekwini Municipal Area (EMA), KwaZulu-Natal, South Africa.

From these TAM/EIS studies, are four findings: (1) low correlation coefficients were calculated for the PU-AT and PEOU-AT constructs; (2) the correlation for perceived usefulness-use was *lower* than for perceived ease of use-use, which is not consistent with Davis' findings; (3) the results *partially* support Venkatesh's (1999) findings that PEOU can be a stronger catalyst (over PU) in fostering IT acceptance; and (4) there is support for Brown's findings [13] - wherein the TAM PEOU-AT relationship was higher than PU-AT. The paper concludes that future research may therefore need to be directed to investigating the role of other potential antecedents, in order to enhance IT adoption and assimilation variances in the EMA. In this regard, some suggestions are made.

Keywords - Executive Information Systems, Technology Acceptance Model, Perceived Ease of Use, Perceived Usefulness.

1 INTRODUCTION

The importance of information for decision-making by executives and managers in organisations, has been extensively documented. Without the provision of concise and timely information [30] [41], executives will not be able to determine whether their views of the environment and their organisation's position within it, remain appropriate [36]. To benefit from information systems (IS) in decision-making, an increasing number of organisations are implementing IS for direct use by executives and managers, in order to access information, both internally and externally to the organisation. An Executive Information System (EIS) is a computerised IS designed to provide managers in organisations with access to internal and external information that is relevant to management activities and decision-making. EIS are found in many organisations in South Africa [8]. Averweg &Roldán[9] suggest that EIS should be flexible enough to support different classes of business data (*e.g.* internal, external, structured and unstructured), and different levels of users such as executives and managers. Nowadays, pervasive computing embeds computing and information technology (IT) into organisational environments, by integrating them seamlessly into the everyday lives of executives and managers, in order to augment decision-making support.

User acceptance of IT has been a primary focus in IT implementation research for the past two decades - where IT adoption and use has been a major goal of organisations. Researchers in the field

rely on the theories of innovation diffusion to study implementation problems [4]. Davis' Technology Acceptance Model (TAM) states that perceived usefulness and perceived ease of use are the two factors that govern the adoption and use of IT [19]. TAM has strong behavioural elements and assumes that when someone forms an intention to act, that they will be free to act without limitation. TAM is one of the dominant research models which have been widely used [17].

The purpose of this paper is to discuss the Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) constructs during EIS development in the eThekwini Municipal Area (EMA), KwaZulu-Natal, South Africa. The paper focuses on the findings of two selected TAM/EIS studies in the EMA:

• A survey of 31 organisations conducted by Udo Richard Averweg, which is reported in Averweg [7] and hereafter referred to as the 'Averweg (2002) study'; and

• A case study conducted at Unilever South Africa (Pty) Ltd (Head Office, Umhlanga Ridge) by Sonny Anyetei Moses Ako-Nai, which is hereafter referred to as the 'Ako-Nai (2005) study'.

Since this paper focuses on the summarised results of these two studies, it should be noted that the research approaches adopted in the Averweg (2002) study and the Ako-Nai (2005) study, are not compared.

This paper reviews IS adoption and use. A review of TAM is presented, and a report on the two selected TAM/EIS studies is given. A summary of the two PU and PEU constructs in these TAM/EIS study findings are presented. The paper ends with some concluding remarks.

2   INFORMATION SYSTEMS ADOPTION AND USE

User acceptance and continuous usage (adoption) are important determinants in gauging success or failure of an IS. Computer or IS usage has been identified as the key indicator of the adoption of IT by organisations [35]. Igbaria& Tan [25] report that system usage is an important variable in IT acceptance, as it appears to be a good surrogate measure for the effective deployment of IS resources in organisations. User acceptance factors have been a long-standing research issue [3]. Clearly, IS adoption and use is an important topic in scholarly discourse.

Since EIS are classified as high-risk projects, organisations are cautious and critical in dealing with them, in order to ensure successful EIS implementation and continuous usage by executives - the intended users [10]. An organisation seeks to avoid failure of its newly implemented EIS, and proactively wants to identify possible factors relating to users' attitudes towards the IS. These factors are likely to influence (positively or negatively) the IS users' acceptance, adoption and use of the system. Lu & Gustafson [31] report that people use computers because they believe they will increase their problem-solving performance (usefulness), and are relatively easy to use. These researchers suggest that the two belief variables, PU and PEOU, are the most important factors determining usage of computers or IS.

3   TECHNOLOGY ACCEPTANCE MODEL (TAM)

TAM was developed by Davis [19] and postulates that two particular beliefs - PU and PEOU - are of primary relevance for computer acceptance behaviours [20] [26] [29]. According to TAM, system use is determined by a person's attitude towards the system (see Fig 1, next page).

The basic TAM model consists of external variables which may affect beliefs. The model is derived from the general Theory of Reasoned Action (TRA) [22], in that TAM is intended to explain computer use. In IT terms, this means that the model attempts to explain the attitude towards *using* IT, rather than the attitude towards IT *itself*. According to Chooprayoon& Fung [17], TAM has been "verified and confirmed by many scholars as a practical theoretical model for the investigation of users' behaviour". Furthermore, according to Singh, Singh, Singh & Singh [33], TAM has examined the attitude and belief of users - that influences their acceptance or rejection of using IT. TAM has the advantage of 'first mover advantage', as one of the early IS theories.
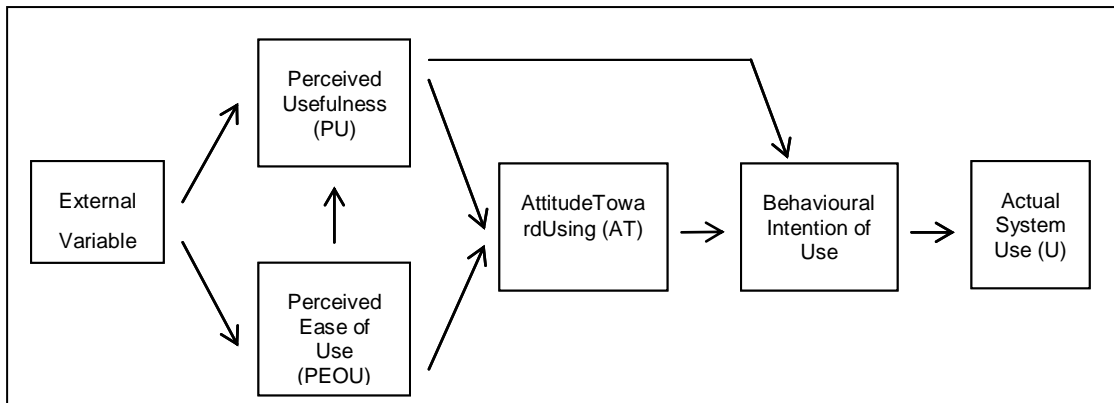
Fig 1: Technology Acceptance Model (TAM) (Source: [20]).

Davis' model specifically postulates that technology use is determined by behavioural intention to use the technology; which is itself determined by both PU and PEOU. Additionally, behavioural intention to use the technology is also affected by PU directly. Behavioural intention to use the technology is then positively associated with Actual System Use (U). The TAM model of IS success relies on the TRA of Fishbein&Ajzen[22] and Ajzen&Fishbein [2] - to assert that two factors are primary determinants of system use:

- *Perceived Usefulness* (PU). PU is defined as the user's subjective probability that using a specific technology will increase his or her job performance, within an organisational setting [20]; and
- *Perceived Ease of Use* (PEOU). PEOU is the end-user's assessment that the IS will be easy to use and requires little effort.

TAM-related studies have found that PU is generally a much stronger predictor of perceived intent to use than PEOU [32]. During the Averweg (2002) study and Ako-Nai (2005) study, the PU and PEOU constructs were operationalised by obtaining end-users' assessment of their PU and PEOU of EIS.

Straub, Keil& Brenner [34] suggest that PU of computers has a positive effect on the adoption of IT. Jeyaraj, Rottman&Lacity[28] report that they "did not find good support for a direct relationship between *Ease of Use* and IT adoption, there is ample evidence of a direct relationship between *Perceived Usefulness* and IT adoption". Adams, Nelson & Todd [1] and Davis [19], report that PU affects both attitudes and actual computer use. Hu, Chau, Liu Sheng & Yan Tam [24] suggest that PU is a significant determinant of attitude and intention, while Brown [13] reports that PU is not a significant influence on use. Later research by Bagozzi[11] questioned the possibility of determining behaviour by adding up measures for PU and PEOU. He considered that there may be differential contributions of salient beliefs. Bagozzi concluded that the TAM model may not be suitable for explaining and predicting system use.

Burton-Jones &Hubona[14] replicated TAM with a survey of 125 employees in a United States of America government agency. Information regarding respondents' beliefs and usage behaviour were collated and analysed. The results showed that PU and PEOU may not mediate all influences from external environmental factors on systems usage. Burton-Jones &Hubona[14] suggested that some external actors (*e.g.* system experience, level of education, age) may have a direct effect on system use. TAM has also been challenged as an appropriate model for developing countries and IS adoption [5].

The most commonly investigated variables of TAM are PU and PEOU [19] [20] [38] [39] [23] [40] [27] [28] [12] [18] [16] [15] [17]. Jeyaraj *et al.*[28] suggest that the high utilisation of PU and PEOU shows the dominance of TAM in individual adoption research, and they state that the constructs have been used in the literature more than twice as often as other constructs. Chang, Chou & Yang [15] indicate that TAM literature "has a steady growth as well as the citations". However, Chuttur [16] suggests that although TAM is a highly cited model, researchers share mixed opinions regarding its theoretical assumptions and practical effectiveness. Nevertheless, Hendriks& Jacobs [23] argue that TAM's popularity derives from its common sense nature, simplicity and robustness. This serves as the rationale for exploring the PU and PEOU constructs in this paper.

4   DISCUSSION OF TWO SELECETED TAM/EIS STUDIES

A discussion of the PU and PEOU constructs of EIS in the Averweg (2002) study and Ako-Nai (2005) study is now given.

4.1   Averweg (2002)study

The Spearman rank-order correlation coefficients r were calculated for PU and AT; and PEOU and AT. Averweg [7] reported that after allowing for tied observations, $r = 0.144$ for PU and $r = 0.373$ for PEOU. These correlation values were considerably lower than expected. For example, Davis [19] reports "Perceived usefulness was correlated .63 with self-reported current use in Study 1 and .85 with self-predicted use in Study 2. Perceived ease of use was correlated .45 with use in Study 1 and .69 in Study 2". Averweg's correlation [7] for usefulness-use ($r = 0.144$) was *lower* than for ease of use-use ($r = 0.373$) and was therefore not consistent with Davis' findings. Furthermore, Averweg reported low correlation values and PU was *not* "significantly more strongly linked to usage than was ease of use" [19]. Davis [19] emphasised that PU and PEOU are people's subjective appraisal of performance and effort, respectively, and do not necessarily reflect objective reality.

4.2   Ako-Nai (2005)study

The Spearman rank-order correlation coefficients r were calculated for PU and AT; and PEOU and AT. They are reflected in Table 1 (below).

Table 1: Spearman rank-order correlation coefficients (Source: [3])

R	Before adjustment	After adjustments
Between PU and AT	0.238	0.238
Between PEOU and AT	0.340	0.459

Ako-Nai[3] reported that the positive correlation coefficients between the variables PU, PEU and AT indicated a relationship between them (as postulated by TAM) and the strength of the relationship is measured by the indicated values (Freund *et al.*, 1993 cited in [3]). However, these values were low and this can be attributed to the low heterogeneous nature of the data results obtained. Ako-Nai reported that following an inspection of the raw data, there were very low variations in response (mostly in the range '5 – slightly agree' and '7 – strongly agree'). Ako-Nai further indicated that a similar result was obtained and highlighted in the Averweg (2002) study. Ako-Nai suggested that a positive but low correlation coefficient can also be attributed to the fact that the EIS at Unilever South Africa (Pty) Ltd is still at its earliest stage of diffusion in the organisation.

Ako-Nai indicated that it was his expectation (and in accordance with the TAM model) that the influence of PU on AT should be greater than that of PEOU on AT. However, the researcher experienced "surprise findings or a lack of expected findings" as there "was the reverse impact values of the two factors, PU and PEU, on AT" [3]. Ako-Nai found that the correlation factor of PEU on AT was higher (both before and after adjustments) than of PU – which is a contradiction of the expectations from the TAM postulated construct.

5   DISCUSSION OF TWO SELECETED TAM/EIS STUDIES

A summary for each of the findings from the Averweg (2002) study and the Ako-Nai (2005) study is now presented.

5.1   Averweg (2002)study

The Averweg (2008) study finding was that PEOU on intended use was greater than the effect of PU on intended use. As the researcher reported low correlation values, an investigation was made by him of the raw data. It was found that if a correlation coefficient is based on only three (out of seven possible different Likert-type scale categories), there is potential for a problem. For higher correlations, greater variation is required from respondents regarding their intended EIS use. In previous findings (see, for example, [4] [35]) significantly higher correlation results were reported. Averweg [7] reported

that while the low correlation results may be disappointing, this may be ascribed to the fact there were very small statistical variations in interviewee's responses.

While the Averweg (2002) study was limited to existing EIS in organisations in the EMA, the researcher felt that due to the similarities between the economy in KwaZulu-Natal and the rest of South Africa, the results can be considered as an approximate indicator for the South African economy. This means that although the researcher's results were limited, they do provide a meaningful reflection of EIS adoption in the EMA. The researcher concluded that in the Averweg (2002) study there was little evidence to support that the theoretical use aspects of TAM were echoed in EIS implementation in KwaZulu-Natal.

5.2   Ako-Nai (2005)study

Ako-Nai[3] reported that high emphasis on PEOU was recorded given respondent's comments on the flexibility of the EIS when compared to previous SAP/BW systems. According to these respondents, such previous IS lacked flexibility, were complex to use and were not user-friendly. On the other hand, since the EIS was more flexible and easy-to-use, the respondents responded positively.

PU scored a high mean value of 5.46. All the contributing factors to PU had mean score values above 5 ('slightly agree') except 'I can still do my work without EIS' and 'EIS provides me with all the information I need' factors. These two factors scored mean values of 4.21 and 3.93 respectively. The mean score value for the 'I can still do my work without EIS' factor suggested that end-users were still able to work and utilise other sources of information. The mean score value for the 'EIS provides me with all the information I need' factor suggested that end-users required additional information that was not available in the EIS. This was triangulated with the fact that respondents confirmed other sources of information: internal information (from other systems and SAP/BW) and external information (from Nielson database sources and customer information from customers). Ako-Nai[3] suggested that this finding may also be a contributing factor to the lower influence of PU on AT (when compared to PEOU on AT) and thereby weakened the perceived useful of EIS. The lower influence of PU was further supported when the respondents were asked whether they would continue to function effectively without EIS. While the respondents responded positively, they stated that it would be 'incredibly' difficult and some complexity will be experienced in obtaining all the information required to make decisions [3].

The researcher in the Ako-Nai (2005) study concluded that for the respondents surveyed, the factors for PEOU and PU had a positive influence on respondents' attitude towards the EIS. The study results also highlighted that PEOU (when compared to PU) has a greater effect on end-users' attitude towards using the EIS.

6   SUMMARY OF THE TWO TAM/EIS STUDIES

User acceptance of technology remains an important field of study in the IS discipline. While many models have been proposed to explain and predict the use of a system, TAM has been *the* model which has captured much attention of the IS community. Despite its frequent use, TAM has been widely criticised and original proponents have attempted to redefine it several times. Attempts by researchers to expand TAM in order to adapt it to constantly changing IT environments has led to "a state of theoretical chaos and confusion" [12].

The Averweg (2002) study and Ako-Nai (2005) study do not support the basic tenets of TAM. TAM has emphasised the importance of PU (over PEOU), as the key determinant of IT acceptance. Empirical evidence has constantly borne out this claim, leading to PEOU being treated as something of a 'step-child' [37]. However, results of Venkatesh's research indicate that PEOU *can* be a strong catalyst fostering acceptance. Both the Averweg (2002) study and the Ako-Nai (2005) study partially support this finding, i.e. PEOU can be a stronger catalyst (over PU), in terms of fostering IT acceptance.

The Averweg (2002) study and Ako-Nai (2005) study both support Brown's findings [13] that "perceived ease of use takes on increased importance, as it influences both usage and perceived usefulness". Doll, Hendrickson & Deng [21] indicate that despite TAM's wide acceptance, a series of incremental cross-validation studies have produced conflicting and equivocal results that do not provide guidance for researchers or practitioners who might use TAM for decision-making purposes.

One possible explanation for this is that human memory may not work in the same way that salient beliefs are processed in TAM. This may result in that the intention to use the EIS may not be representative enough of actual use – the time period between intention and adoption can be mitigated by decision-making uncertainties which may influence an individual's decision to adopt and use an IT. In a developing country in Africa, the conventional wisdom that PU is the main predictor of adoption, has been challenged [6]. It appears that application of the TAM model to IS (such as an EIS) in developing countries should be guided more by the specificities of local circumstances than by the performance of the TAM model in developed countries.

In summary then, the Ako-Nai (2005) study findings corroborated the earlier findings of the Averweg (2002) study. The four major findings (from *both* studies) are now summarised:

- Low correlation coefficients were calculated for the PU-AT and PEOU-AT constructs;
- The correlation for perceived usefulness-use was *lower* than for perceived ease of use-use, which is not consistent with Davis' findings;
- The results *partially* support Venkatesh's[37] findings that PEOU can be a stronger catalyst (over PU) in fostering IT acceptance; and
- there is support for Brown's findings [13] - wherein the TAM PEOU-AT relationship was higher than PU-AT.

7   CONCLUDING REMARKS

Since the Averweg (2002) study and Ako-Nai (2005) study were conducted, pervasive computing has resulted in a move away from "the traditional desktop model of computing towards having technology embedded in the environment" [18]. Future research may therefore need to be directed to investigating the role of other potential antecedents, in order to enhance IT adoption and assimilation variances in the EMA.

While it may be tempting to conclude that research on TAM may have reached a saturation level, future research should focus on developing new models that will exploit the strengths of the TAM model while discarding its weaknesses [16]. One suggestion in this regard, is investigating specificities of local circumstances and contextual factors such as experience, level of education, age, gender and socio-economic status conditions - to increase the final IT use prediction of EIS, in organisations in the EMA. Furthermore, general pervasive computing conditions in organisations in South Africa may serve as an appealing context in which to investigate IT adoption. Possible extensions to TAM should also be considered. Such IT acceptance studies should pay attention to issues of significance in assessing the contributions of variables explaining IT usage for decision-making by executives and managers in these organisations.

8   ACKNOWLEDGEMENT

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