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Sector diversity in Green Information Technology practices: Technology Acceptance Model perspective

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ABSTRACT

This paper examines the existence of diversity between public-and private-sector establishments in Green Information Technology (GIT) adoption using the 'Technology Acceptance Model' (TAM). In this study, GIT simply refers to using IT in ways that help to reduce environmental impacts, which include using energy more efficiently and reducing waste. The model is extended to include the external variables as subjective norm and the level of GIT awareness. For this purpose, a survey was conducted among professionals from public- and private-sector establishments. The findings suggest the following: (1) Diversity exists among establishments from public- and private-sectors in the influence of the Perceived Ease-of-Use (PEU) on Perceived Usefulness (PU) and on the Attitude Towards Use (ATU); (2) Most of the public-sector professionals have concerns for environmental sustainability in using IT; (3) TAM is an important tool for investigating the specific barriers and facilitators of environmental behavior at work; (4) TAM has a have significant predictive power in public -sector establishments; and (5) TAM is significant for private-sector establishments except the relations between the PEU and PU, and PEU and ATU.

1. Introduction

Green IT refers to the using of Information Technology (IT) resources in an energy-efficient and cost-effective manner (Bose & Luo, 2011), and it is foreseen as the most important strategic technology in the imminent future. According to Mines (2009), the GIT service market was expected to reach nearly $5 billion by 2013. Organizations are now actively pursuing GIT solutions for a multitude of reasons and benefits, including lower power consumption, lower costs, lower carbon emissions, less environmental impact, improved system performance and use, increased collaboration and interaction amid constituents, space savings, and an agile workforce (Bose & Luo, 2011). According to a 2009 GIT report surveying 426 companies in North America including a total of 1052 companies worldwide, 86% stated that it is significantly important that their IT organization implement GIT initiatives. This report also states that 97% of these firms are at least considering a GIT startegy (Symantec, 2009).

GIT is attributed to the initiatives and programmes that directly or indirectly address environmental sustainability. According to Siegler and Gaughan (2008), GIT is about information technology and system initiatives, including programs that address environmental sustainability. It also addresses energy consumption as well as waste associated with the use of hardware and software which tends to have a direct and positive impact (Jenkin, McShane, & Webster, 2011a). Hilty et al. (2006) also support this view by stating that the production, use, and disposal of IT have a direct effect on the natural environment and eco-sustainability (Hilty et al., 2006). Estimates indicate that the IT industry accounts for 2% of global CO_2 emissions, which is equivalent to the amount generated by the aviation industry (Goasduff & Forsling, 2007). Jenkin et al. (2011a) outlined the objective of GIT to be reducing the overall environmental impact of Information Communication Technology (ICT) by adopting a number of measures ranging from (1) taking environment-friendly approaches to the production; and (2) use of IT equipment and facilities to optimize the use of ICT equipments along with network infrastructure in order to reduce energy consumption at every stage.

A study by the Australian Computer Society (2010) noted that in 2009 Australia's ICT users consumed 13.248 million KWh of electricity which generated an equivalent of 14,248 million tonnes of CO_2 emission, which is nearly 2.5% of Australia's total emissions (539 million tonnes). In 2010, Google's overall consumption of electricity was reported to be 2.26 million MW h (Albanesius,

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2011) and, as Google has operations and major servers in many countries with different types of energy sources and different Green House Gases (GHG) emission rates, it is difficult to accurately translate this energy consumption figure to its GHG emission equivalent. Corbett, Sayili, Zelenika, and Pearce's (2010) analysis of articles published in the CIO magazine shows that economic benefit is the most commonly cited driver for Green IT. In Australia, the ANZ Bank's initiative to eliminate screensavers has resulted in approximately 4% reduction in the annual electricity bill with an estimated value of AU$500,000 per year (Molla & Cooper, 2010). A global survey of 1260 IT professionals indicated that 50% are concerned about climate change (Info-Tech, 2008). Governments, in particular, can encourage the adoption of Green IT by legislations that create the framework for a low carbon economy (Chen, Boudreau, & Watson, 2008).

Even though research to date suggests that organizations often fail to incorporate the Information Technology (IT)/Information System (IS) functions into their environmental assessments (Huang, 2008), and to allocate personnel to address environmental issues (Siegler & Gaughan, 2008), few empirical studies have examined whether – and if so, how – organizations are incorporating IT/IS into their environmental management practices. Organizational motive for IT adoption is a suitable, albeit largely under-used, theoretical lens in IT research (Rahim, Shanks, & Jagielska, 2010). Such a perspective can also provide useful insights as to what extent eco-sustainability considerations are influencing the IT decision-making process in establishments. Further, the understanding of such motivations can be beneficial to IT managers and other practitioners as it helps them to justify their Green IT actions or inactions and to effectively participate in organizational eco-sustainability strategic discourses (Molla & Abrashie, 2011).

Green user behavior has been recognized as an important component of GIT or Green IS (Jenkin et al., 2011a), and several projects have looked at the user behavior with regard to energy consumptions and user perceptions of their environmental impact. A review of the literature reveals that IT usage behavior among the public-sector employees is different from that of their private-sector counterparts (Gupta, Gould, & Pola, 2004; Lau, 2003). Furthermore, the literature also accepts motivational differences between public- and private-sector establishment (Nel et al., 2001; Rashid & Rashid, 2012). However, available studies do not focus on the assessment of behavioral differences of professionals from these establishments in terms of GIT usage in organizations. Additionally, the literature on Green IT/IS is more recent, yet less developed. Although there is some research at individual levels, the majority of the Green IT/IS studies are at the organizational level of analysis (Jenkin et al., 2011a). This means the investigation of the differences in the behaviors of public and private sector employees' adoption of GIT remains a popular and unexplored field of research.

Technology Acceptance Model (TAM), the Theory of Reasoned Actions (TRA), and the Theory of Planned Behavior (TPB) are amongst the well-recognized conceptual theoretical models in IT research. TAM has been extensively adopted in prognosticating the determinants of adoption and technology usage in various settings (Lim, Lim, & Heinrichs, 2008). It proposes a link between the acceptance of technology and utilization behavior (Nikkheslat, Zohoori, Bekheirnia, & Mehrafshar, 2012). However, little systematic research has been conducted with in the GIT context, indicating a significant gap in our knowledge. Therefore, given the substantial and growing significance of Green IT in advancing environmental sustainability and business efficiency, the proposed framework in this research utilizes TAM to empirically investigate the existence of diversity between public- and private-sector establishments for the adoption of GIT.

The rest of the paper is organized in eight sections. The following section reviews background literature on TAM and IT adoption in organizations. Section three develops the research model and hypotheses. The research instrument, along with data and empirical findings are described in the fourth and the fifth sections respectively. After discussing the main findings in the sixth section, the seventh addresses GIT policy and implications. Finally, the last section highlights the main contributions and some of the limitations of the study that chart avenue for future research.

2. Literature review

Technology Acceptance Model (TAM), introduced by Davis in 1989, is one of the most cited frameworks to understand and predict the process of user acceptance or adoption of information systems. The present study uses this model as the theoretical basis for the development of a new model towards GIT selection among IT professionals. TAM has been used primarily to explain the usage of IT (Ma & Liu, 2004). However, research has supported its use for investigating IT decision-making as well (Benamati & Rajkumar, 2002). It establishes that the Perceived Ease-of-Use (PEU) and Perceived Usefulness (PU) can predict ones' attitude towards the use of a given technology. Then, the Attitude Towards Use (ATU) can, in turn, predict the behavioral intention to use and, finally, intention predicts the Actual Use (AU) of that technology (Davis, 1989). Behavioral intention is a measure of the strength of one's willingness to make an effort while performing certain behaviors. Also, attitude illustrates a person's favorable or unfavorable assessment regarding the behavior in question. TAM has been validated over a wide range of systems (Karahanna & Limayem, 2000). It has also proven to possess reliable and valid constructs (Chin & Todd, 1995) and has routinely explained up to 40% of usage intentions and 30% of systems usage (Meister & Compeau, 2002).

A variety of applications have been used to validate the model (Ma & Liu, 2004). For example, it was employed to study user acceptance of the World Wide Web (Lederer, Maupin, Sena, & Zhuang, 2000), software, and decision support systems (Morris & Dillon, 1997). Over the past decade, TAM appears to have become well-established as a robust, powerful, and parsimonious model for predicting user acceptance (Venkatesh & Davis, 2000). Previous attempts to study TAM have largely focused on personal computer usage or relatively simple software applications, such as E-mail, word-processing programs, spreadsheet software, and the Windows operating system (Davis, 1989; Mathieson, 1991). Recently, in line with the development of the Internet and Internet-based technologies, various applications of TAM have been made in the areas of organizational contexts, e-commerce (Jiang, Hsu, & Klein, 2000), tele-medicine (Chau & Hu, 2002; Karahanna, Straub, & Chervany, 1999), digital library systems (Thong, Hong, & Tam, 2002), and dynamics of users' belief in software application adoption (Lee, Yan, & Joshi, 2011).

In addition to the relationships proposed by TAM, many researchers have studied the antecedents of PU and PEU (Dishaw & Strong, 1999; Lederer et al., 2000). Some have also ignored ATU and/or the intention to use (Gefen & Straub, 1997) and, instead, focused on the direct effect of the ease-of-use as well as usefulness in system usage. Others have suggested that TAM could be used for areas other than end-user and software acceptance (Agarwal, Prabuddha, Sinha, & Tanniru, 2000). For example, Benamati and Rajkumar (2002) applied TAM to technology-related decision-making by employing a qualitative methodology to investigate the predictive capability of TAM for studying the decisions regarding outsourcing of application developments.

A review of the literature indicates the existence of applications of conceptual models for the assessment of environmental issues. For example, Han, Hsu, and Sheu (2010) proposed and tested TPB model to explain the formation of hotel customers' intentions to