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Theory of Reasoned Action application for Green Information Technology acceptance

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ABSTRACT

The increase in the use of Information Technology (IT) in recent decades has contributed to additional power consumption as well as a potential overuse of scarce resources. Also, IT is quickly surpassing air transportation in terms of its carbon footprint. For these reasons, increased environmental awareness has increased interest in Green Information Technology (GIT) among IT practitioners. Therefore, the aim of this paper is to investigate behavior for the adoption of GIT applying the conceptual model, referred to as the 'Theory of Reasoned Action' (TRA). For this purpose, a survey was conducted among IT professionals from major public and private sector establishments. Findings indicated that behavioral intention influences actual behavior positively. IT professionals with positive intentions towards GIT issues are actually practicing GIT in their work. Results also indicated that external factors such as person related beliefs, sector of respondents' establishment, and level of awareness have significant impact on attitude towards adoption of GIT.

1. Introduction

Most developed countries have been rather concerned with environmental deterioration and how it shapes their economies and policies (Ramayah, Lee, & Mohamad, 2010). With increasing affluence derived from rapid economic development, citizens in various parts of the world are becoming more and more concerned about the hazardous impacts of environmental deterioration on their everyday life (Li, 1997). On the other hand, the usage of energy and its increasing costs are relevant issues as well.

There is clear evidence that the Information Technology (IT) has a predominant role in reducing energy consumption, both as a tool to monitor and optimize the energy efficiency of any production process, and as a target of energy efficiency initiatives (Capra, Francalanci, & Slaughter, 2012). The production, use, and disposal of IT have a direct effect on the natural environment and eco-sustainability (Hilty et al., 2006; Köhler & Erdmann, 2004). Estimates indicate that the IT industry account for 2% of global CO2 emissions, which is equivalent to the amount generated by the aviation industry (Gartner, 2008).

Expenditures with regard to IT have important implications for the environment, and the increasing use of this technology in recent decades has undoubtedly contributed to additional power consumption as well as a potential overuse of scarce resources (Hedwig, Neumann, & Malkowski, 2009). For instance, in 2008 Gartner predicted that 80% of data centres would be running at their maximum available power and cooling levels by 2010 (Uhlman, 2008). Gartner predicts an increase in server acquisitions in 2010 and 2011 which will further exacerbate the issue (Kumar, 2010). As the force of the Moorse law continues to shorten the average life span of IT, electronic-waste is emerging as one of the fastest growing waste that requires serious attention. For instance, in Australia, over 1.6 million computers are dumped in landfills each year and e-waste is growing faster than general municipal waste (Harper, 2006). Although estimates vary, the IT sector produced 1.3% of global green house gas emissions in 2007 and used 3.9% of electricity (Malmodin, Moberg, Lundén, Finnveden, & Lövehagen, 2010). The Internet alone accounts for 10% of energy consumption in the US (Berthon & Donnellan, 2011). For these reasons, concerns regarding climate change along with an increased environmental awareness have spurred interest in sustainable development and Green Information Technology (GIT) both in the field of Information Systems (IS) (Melville, 2010) and among IT practitioners (Webb, 2008). Jenkin, McShane, and Webster (2011a) suggested that organizations are still in infancy stage of awareness and adoption of "Green" IT/IS. They found four types of gaps in this context: knowledge gaps, practice gaps, opportunity gaps, and knowledge-doing gaps. Jenkin, Webster, and McShane

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(2011b) also envisaged that environmental orientation is made up of three components – environmental attitudes, cognitions, and behaviors – both at employee and organizational levels. This orientation reflects the degree to which an organization and its employees have implemented and institutionalized the organization's environmental initiatives. In the last decade research in GIT has been evolving in different dimensions.

The green IT strategy, design, and practice initiatives within organizations have recently evolved into an active research area in the information system discipline. As a matter of fact organizations are still in the early stage of awareness and adoption of green IT/IS and there are few empirical researches in the area of green IT (Bose & Luo, 2011; Jenkin et al., 2011a). Some empirical studies have explored individual adoption issues of environmental information systems (e.g., Haigh & Griffiths, 2008; Smart, Armstrong, & Vanclay, 2007). In these studies, cognitions, behaviors, and to some degree attitudes regarding green IT/IS were assumed significant during system analysis and design and adoption. Organizational motive for IT adoption is a suitable, albeit largely underused, theoretical lens in IT research (Rahim, Shanks, & Jagielska, 2010). Understanding of the motivations is useful to IT managers and other professionals as it helps them to justify their green IT actions or inactions and to effectively participate in organizational eco-sustainability strategic discourses (Molla & Abareshi, 2011). To examine human behavior the TRA provides an important fundamental conceptual model.

The Theory of Reasoned Action (TRA) provides an important fundamental conceptual model for examining human behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The aim of the TRA is to investigate the relationship between attitude and behavior based on two major concepts: "principles of compatibility" and "behavioral intention". With this characteristic, the TRA is a predictive model and, therefore, is used in a variety of fields, such as banking, public, education, and industries to predict individual's actions based on certain criteria. Information Technology is one of these fields. As supported above by a number of authors, there are limited empirical studies in the field of green IT and we could not find any study which relates green IT and the TRA together towards the purchasement of hardware, and software and the incorporation of green IT issues into organizational computing environments. Therefore, the objective of this paper is to analyse the adoption of Green Information Technology issues using the conceptual framework based on the behavioral intention model referred to as the TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). These findings may have significant implications to identify awareness among IT professionals towards environmentally sustainable approaches in their different tasks.

The remainder of the article is organized as follows: Section 2 presents the literature review, followed by the research methodology and hypotheses in Section 3. Section 4 describes the validity and reliability of the instruments used in this research. Section 5 presents the test results followed by discussion. The last section concludes with findings of the study and provides implications based on the findings.

2. Literature review

2.1. Green IT adoption

Practitioners have begun to focus on 'Green IT', but there is still little research in this area (Jenkin et al., 2011b). Chou and Chou (2012) proposed a Green IT value model consisting of four major components – awareness, translation, comprehension, and Green IT value – to depict the relationship among these components and their impact over Green IT. To motivate further research in this crucial area, Jenkin et al. (2011b) presented a framework including four components – motivating forces, environmental initiatives, orienting environmental initiatives, and impacts of environmental initiatives – and propositions focused on the employee level. Molla and Abareshi (2012), in their study of organizational green motivations for information technology, found that eco-efficiency (cost reduction) and eco-effectiveness (such as their eco-sustainability belief and value system) strongly influence the adoption of Green IT. The main reason for organizations undertaking Green IT initiatives is to reduce operating costs and minimize the environmental impacts of business processes (Dedrick, 2010). Additionally, the major catalysts of Green IT adoption are soft benefits, such as employee morale and good corporate citizenship (Olson, 2008) along with better corporate image and pressure of regulation (del Rio Gonzalez, 2005). Further, strong environmental performance tends to help attract, motivate, and retain skilled employees (Fernandez, Junquera, & Ordiz, 2003). IT/IS can be used by management and human resources to enhance employee commitment to environmentally-friendly practices by diffusing environment-related information through the company (Chen, Boudreau, & Watson, 2008; Manning, 2007). Furthermore, given the importance of employee buy-in and involvement in environmental initiatives (Ramus, 2002), additional research is needed to understand the role of employees in determining, both directly and indirectly, the success of Green IT/S practices (Jenkin et al., 2011a). Chow and Chen (2009) examined IT users' perception of their intended belief and actual green computing behavior.

2.2. Theory of Reasoned Action (TRA)

The TRA has been utilized by researchers to investigate human behavior in the disciplines of social psychology (Conner, Kirk, Cade, & Barrett, 2001), and has found support in the prediction of various social behaviors in the literature (van den Putte, 1991). For example, Teo and van Schaik (2012) compared the four models (TRA, TPB, TAM, and integrated) to examine which model best helps to predict preservice teachers' intentions to use technology. Shih and Fang (2006) replicated and expanded the TRA to probe the attitude and subjective norms factor that would influence the adoption intention of Internet Banking. Lam, Cho, and Qu (2007) explored the relationship between IT beliefs, attitude, subjective norms, self-efficacy, and behavioral intention towards the perception of adoption of information technology by hotel employees in China. Ramayah et al. (2010) examined the motivational perspective of the TRA in terms of how individual values and attitudes in a developing country influence purchasing intention of a green product.

Attitudes are sets of beliefs about a certain object or an act which may translate into intention to carry out the act (Schwartz, 1992). In the TRA, attitude is equated with the attitudinal belief that performing a behavior leads to a particular outcome, weighted by an evaluation of the desirability of that outcome (Teo & van Schaik, 2012). Fishbein and Ajzen (1975) mentioned that subjective norm is related to the normative belief that a person complies with the expectations from other people, such as a person's family or friends, supervisor, or society at large. Intention, on the other hand, is a determination to act in a certain way. Intention in an attitude–behavior relationship is influenced by the level of effort required to exercise the behavior (Bagozzi, Yi, & Baumgartner, 1990).

2.3. Relationship between TRA constructs (attitude, subjective norms, behavior intentions, and actual behavior)

Follows and Jobber's (2000) literature review on environmentally responsible purchase behavior noted that green attitudinal

measure is operationalized by incorporating statements concerning several environmental issues. It was also established that the attitude–behavior correlation was greater when attitude was operationalized as a specific environmental behavior rather than to a general attitude toward the environment (Hines, Hungerford, & Tomera, 1987). Subjective norms are important in an organizational setting (Taylor & Todd, 1995a). Venkatesh and Davis (2000) also reported that organizational variables such as social norms are more important than the user's perceptions of the IT in predicting system usage and acceptance. Therefore, the social normative component captures the collective effect of these influences on behavioral intention (Lam et al., 2007). Earlier studies have used behavioral models or behavioral decision theories to explain the usage of information system (Agarwal & Prasad, 1997; Davis, 1989), and the results indicate that behavioral intentions are significantly and positively correlated with actual behavior in the field of IS. The findings imply that an effective use of information technology relies on positive intention towards the adoption of IT. The intention to purchase a specific product has been found to be a good predictor of actual behavior in purchasing the product (Ramayah et al., 2010).

2.4. People and pro-environment behavior

Empirical studies on environmental concerns show inconclusive results in examining the relationship of people and their likelihood to practice environmentally responsible behavior (Ramayah et al., 2010). Del Brio, Fernández, and Junquera (2007) found that employees' motivation in the environmental activities is positively related to the companies' capability to achieve an environment action-based advantage. In a study conducted in Turkey, Bodur and Sarigollu (2005) indicated that attitudes toward specific behaviors were found to be the best predictors of behavior, followed by general attitudes, education, and locus of control. They found that environmentally concerned consumers are better educated than others, and age, gender, and family size do not have significant impacts on the degree of their environmental concerns. Do Valle, Reis, Menezes, and Rebelo (2004) suggested differences between recyclers and non-recyclers concerning specific attitudes toward recycling, and also the need for improving the provided logistic services. Bodur and Sarigollu (2005) also found that items measuring attitudes towards specific behaviors are better predictors of environmental behavior than are those measuring general attitudes towards the environment. Amel, Manning, and Scott (2009) explored the connection between mindfulness and sustainable behavior, and found that awareness was significantly positively correlated with self-reported sustainable behavior. Pickett-Baker and Ozaki (2008) identified that consumers are not exposed enough to green product marketing communication, and suggested that the market for greener products could be exploited more within consumer groups that have pro-environmental values.

2.5. Role of personal beliefs and awareness towards behavior

There are diverse results about the impact of personal beliefs and awareness on the behavior of an individual. Management information system (MIS) researchers have identified perceived beliefs in usefulness, ease of use, compatibility, image, and trialability of an innovation are the key influences on the behavior of technology adoption (Davis, 1989; Liao & Landry Jr., 2000). The perceived IT beliefs have the greatest impact on the attitude of hotel employees towards behavioral intentions of adopting IT (Lam et al., 2007). On the contrary, individual attitudes and beliefs about the environment are often incongruent with behaviors (Ohtomo & Hirose, 2007).

From a behavioral aspect, there are discrepancies between people's awareness of environmental issues and their behavior (Mitomo & Otsuka, 2012). Since environmental degradation proceeds very slowly, people would not take it urgent and delay action even after having acquired related information and recognized the seriousness (Mitomo & Otsuka, 2012). On the other hand, Amel et al. (2009) found that individuals who are more mindful (aware and attentive) report more sustainable behavior. This is because mindful individuals are more likely to attend to their surroundings and be aware of environmental impacts (Jenkin et al., 2011b).

3. Research methodology

3.1. Research model

The objective of this paper is to analyse the acceptance of Green Information Technology using a conceptual framework. The framework is based on the behavioral intention model referred to as the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA was selected since it is developed as an improvement over Information Integration Theory, and used to predict behavioral intent by attitudes and subjective norms (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Additionally, the model has been found successful in different studies for predicting behaviors towards computer use (Godin, Gravel, Eccles, & Grimshaw, 2008; Nink, 2003). The TRA model traditionally involves four constructs (Fig. 1) such as "Attitude Towards Behavior (ATB)", "Subjective Norms (SN)", Behavioral Intention (BI)", and "Actual Behavior (AB)". The TRA has been used to understand behavior in environmental studies. For example, Bang, Ellinger, Hadjimarcou, and Traichal (2000) employed the TRA as a theoretical framework to investigate the relationship between awareness about renewable energy and beliefs about salient consequences of using renewable energy. Marandu, Moeti, and Joseph (2010) investigated the power of the TRA in explaining conservation of residential water use in Botswana. Recently, Kim, Jeong, and Hwang (2013) used the TRA to predict American and Korean students' intentions to engage in behaviors that can help mitigate climate change. Most of these studies reported predictive power of the TRA. This study also uses the TRA to explain GIT adoption behavior of IT professionals.

Ajzen and Fishbein (1980) elaborated the TRA to include external variables. These variables make the theory more general in terms of its application to consumer behavior and provide encompassing explanation of behavior (Crosby & Muehling, 1983). Additionally, the TRA proposes that external variables intercede indirectly impacting attitude, subjective norms, their relative weight (Filimban & Aljahdali, 2009). Individual beliefs, sector and experience of respondents, and level of awareness have been used as external variables in many studies. For example, Yaghmaei (2010) considers individual's belief to be one of the factors in the TRA since it is believed to be significantly relevant in the process of forming attitude towards behavior. This means, inclusion of personal beliefs may lead to deeper understanding of actual usage (Yousafzai, Foxall, & Pallister, 2010). Vardi and Weitz (2002) used the Theory of Reasoned Action to investigate the role of organizations for professionals' behavior. They reported significant relationship. Additionally, Godin et al. (2008) used the TRA to investigate the usefulness of social cognitive theories and, as a result of their systematic review, they proposed that future studies should take into consideration methodological aspects in order to contribute to the development of a significant corpus of data on the behaviors of professionals. Nink (2003) used the TRA to examine variables influencing acceptance of the web. This study stated that the system characteristics, which includes quality, security, special features, compatibility, values etc., should be one of the

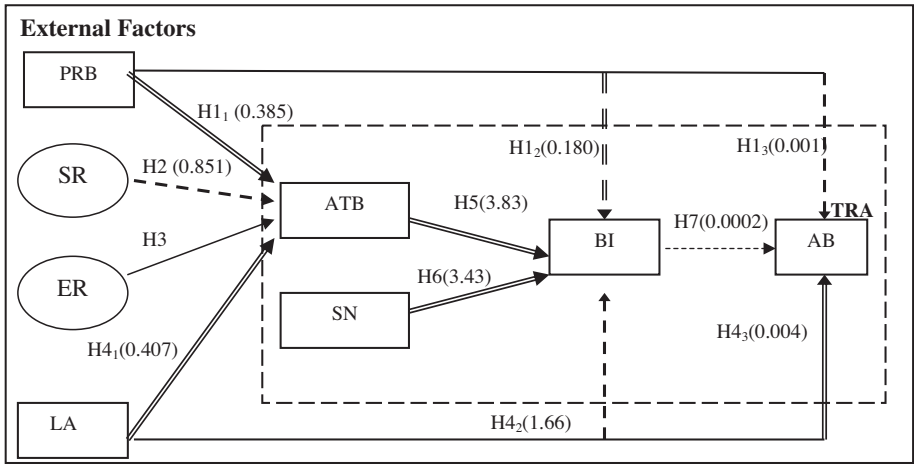

Fig. 1. Research model and test results. Boxes represent the factors and the casual effects (hypotheses H_i) are shown by arrows connecting the boxes. The constructs inside the dashed rectangle represents the TRA, whereas others are extensions to the TRA. Double lines represent supported hypotheses for $p < 0.001$, double dashed lines represent supported hypotheses for $p < 0.01$, dashed lines represent supported hypotheses for $p < 0.05$ and single lines represent not supported. The path coefficients are given only for the supported hypotheses inside parantheses.

external factors to be examined in greater detail in future studies. Crosby and Muehling (1983) studied the relationship between external variables and Theory of Reasoned Action Model (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). They proposed awareness to be one of the external variables. According to their study, awareness may be the direct antecedent of behavior. Noh (2008) used experience as one of the external factors of their conceptual model the TRA to investigate online shopping beliefs, attitudes, and purchase intentions in a multichannel shopping environment. This study reports experience to have significant contribution for adopted model. Additionally, broad-based personal beliefs about the natural environment have been shown to correlate with different pro-environmental behaviors and intentions (e.g., Cordano, Frieze, & Ellis, 2004; Dunlap, Van Liere, Mertig, & Jones, 2000).

In the light of above findings, this study uses the TRA as the conceptual framework model along with the four external factors (Fig. 1) as "Person Related Beliefs (PRB)", "Sector of Respondent (SR)", "Experience of Respondent (ER)" and "Level of Awareness (LA)". Among these, PRB and LA are constructs, whereas SR and ER are not (Fig. 1). Unlike most other researches, this study focuses on the point of view of the IT professionals since GIT is a new concept and IT professionals are observed to be of higher awareness on the issue than any other groups (Molla & Abareshi, 2011).

3.2. Hypotheses regarding external constructs

As suggested by Butler (1999), external variables should be included in research involving the TRA if there are research-based reasons to believe that these variables have some influence. Yaghmaei (2010), Beadnell et al. (2008) and Crosby and Muehling (1983) are examples of studies, supporting this view. Yaghmaei (2010) reported that the external variables can have an influence in one of the three ways, such as influence on attitudes and significant amount of weight on intention, influence on the subjective norms and significant amount of weight on intention, and influence on the relative weights of the two components. Beadnell et al. (2008) used intrapersonal, interpersonal, and socio-cultural as their external variables and reported their direct influence on either intention or behavior. In their research based on the Fishbein's model (Fishbein and Ajzen, 1975), Crosby and Muehling (1983) tested the prescribed role of external variables in a consumer behavior context, and reported that external variables have a direct impact on intentions. They also stated that external variables are completely mediated by a set of endogeneous variables. The external variables bridge the attitudes and behavioral intentions with various individual differences, situational constraints, and other more or less controllable interventions impinging on behavior (Davis, Bagozzi, & Warshaw, 1989). Therefore, the concept of external variables is important and is originally recommended to be examined in greater detail in research (Al-Gahtani & King, 1999). Against this backdrop, this study uses external factors as "Person-Related Beliefs (PRB)" of respondents, "Sector of Respondents' workplace (SR)", "Experience of Respondents (ER)" and respondent's "Level of Awareness (LA)" (Fig. 1, Table 1). The motivation for using these factors and justification of corresponding hypotheses are given in the following paragraphs.

The foundation of the TRA theory rests on the distinctions between beliefs, attitudes, intentions, and behavior (Yaghmaei, 2010). It also shows the relationship between beliefs and behavior through attitudes, subjective norms, and behavioral intentions. There is significant literature, which provides discussions and supporting evidence on this issue (see, for example, Burton-Jones & Hubona, 2006; Taylor & Todd, 1995b). Taylor and Todd (1995b) argued that increased experience with IT allows a stronger relationship to form between beliefs, attitudes, and IT use. Burton-Jones and Hubona (2006) studied the relationship between beliefs and behavior based on a sample of 125 employees from a government sector establishment. Their findings show that the TRA proposes that the effect of external variables is completely mediated by the users' beliefs and they influence attitudes about using a system. In other words, an individual's behavior is driven by evaluative beliefs. In a more recent study, Melas, Zampetakis, Dimopoulou, and Moustakis (2011) reported beliefs to be valuable because beliefs influence subsequent behavior. Melas et al. (2011) also pointed the case of different belief formations. Similarly, Sutton et al. (2003) used the concept of salient behavioral beliefs and pointed the need for elicitation study to identify the model salient beliefs in the target population. They reported that salient beliefs that were elicited by their questions differ systematically from those that were elicited by the traditional questions.

The factor belief has been studied in the context of environmental sustainability. Young (2008) stated that "environmental behavior" is a complex phenomenon driven by multiple variables. Thus, when trying to influence people's behavioral decisions, it is important to remain cognizant of all the various factors that have been found to influence people's pro-environmental behavioral

Table 1
List of constructs and corresponding items.

Construct/variable	Item
Subjective Norms (SN)	I think that my colleagues expect me to practice GIT
	I think that people who are important to me practice GIT
	I think that people who are important to me expect me to practice GIT
Attitude Towards Behavior (ATB)	Practicing GIT is convenient for me
	Practicing GIT is necessary for me
	Practicing GIT is worth it
Behavioral Intention (BI)	I intend to consider GIT when buying a new hardware
	I intend to consider GIT when buying a new software
	I intend to consider GIT depending on the type of my ICT usage
	I intend to consider GIT depending on the place of my ICT usage
Actual Behavior (AB)	I practice GIT while using ICT
Person Related Beliefs (PRB)	I believe that PC manufacturers are one of the major players who can reduce the overall negative impact of PCs
	I believe that software developers are one of the major players who can reduce the overall negative impact of PCs
	I believe that users are one of the major players who can reduce the overall negative impact of PCs
Sector of Respondent (SR)	What is the sector of your establishment? (public; private)
Experience of Respondent (ER)	How long you have been engaged professionally in Information and Communication Technologies (ICT) experience (years)?
Level of Awareness (LA)	In general I believe I am sufficiently aware of environmental issues
	I believe I am sufficiently aware of the effect of GIT on the environment
	I believe I am sufficiently aware of practicing GIT

intentions and behaviors. Young (2008) also reports beliefs as one of those factors. Han, Hsu, and Sheu (2010) also supported that intentions concerning environment are associated with behavioral and normative beliefs. More specifically and interestingly, with increasing experience, general beliefs regarding computers and computer use continued to be an important factor (Venkatesh, 2000). Additionally, according to Jenkin et al. (2011a) the literature identifies the importance of environmental values and beliefs in terms of using IT.

All these can be used as the motivation to include PRB as one of the factors in our study to evaluate perceptions about the role of hardware manufacturers, software developers, and users of IT in terms of practicing GIT. Therefore, we postulate the following hypotheses:

$H1_1$: PRB has significant impact on ATB.
$H1_2$: PRB has significant impact on BI.
$H1_3$: PRB has significant impact on AB.

IT experience, in particular, appears to be one of the key elements in using IT (Jaeger, 2003). Computer experienced individuals will know more about how to use ICTs and this naturally increases practical compatibility in adopting new technologies (Sait, Al-Tawil, & Hussain, 2004). Noh (2008) and, Burton-Jones and Hubona (2006) have been supporters of this view. They reported experience to have significant contribution for adopted model and therefore proposed experience as one of the external variables in utilizing conceptual research models such as the TRA and TAM. The experience has also been used in environmental studies and reported to have influence in establishing consistency and continuity for pro-environmental self-identity (Whitmarsh, 2008). According to a more recent study, employee experience is one of the factors that explains the variance in intentions of pro-environmental behavior (Greaves, Zibarras, & Stride, 2013). Greaves et al. (2013) also stated that previous literature does not provide much research investigating relationships between experience and behaviors relevant to energy consumption.

On the other hand, organizational characteristics and values play an important role in shaping individuals' attitudes towards the use of IT (Jin, Drozdenko, & Bassett, 2007). Some studies reported significant differences between the type of IT applications among organizations from public and private sectors (see for example Gupta, Gould, & Pola, 2004; Lau, 2003). Lau (2003) and Gupta et al. (2004) reported significant differences between the types of IT applications among organizations from different sectors. Other studies pointed the existence of instrinsic and extrinsic motivational factors in the workplace and reported the role of work environment on employees' technology acceptance (Fagan, Neill, & Wooldridge, 2008; Roca & Gagne, 2008). A conceptual framework model approach has also been adopted to explore environmental behavioral intentions in different workplace settings (Greaves et al., 2013). It was concluded that it may be tempting to extrapolate the findings of research to workplaces with different characteristics since employees' pro-environmental manner may be different depending on the workplace. Similarly, Spence, Pidgeon, and Uzzell (2009) and Carrico and Reimer (2011) are amongst the other studies drawing attention of researchers to environmental behavior in the workplace. However, existing literature paid little attention on the relationship between organizational factors and pro-environmental behavior and future research was proposed (Greaves et al., 2013). Such studies may ascertain the importance of working system type in technology acceptance behavior towards environmental sustainability. This may also provide guidance to practitioners, who are endeavoring to increase the successful adoption of a wide range of technologies (Fagan et al., 2008).

All these may be taken as an evidence of the fact that the respondents attitude in adopting GIT may be shaped according to the experience and sector of their organizations. Based on this fact we propose following hypotheses.

H2: SR has significant impact on ATB.
H3: ER has significant impact on ATB.

Regarding IT, awareness is generally taken in two different categories as 'ICT awareness' and 'awareness on ICT-related issues'. This study uses the latter since the focus is given to the inspection of relationships among factors in GIT. The awareness has been vastly used in many of the empirical studies in different fields of ICT. In her report, Young (2008) also stated that awareness is an important factor influencing people's behavioral intentions and decisions. Another supporting view is provided by Venkatesh (2000), stating that with increasing experience, awareness regarding computers, and computer use continued to be an important factor. Bjorn, Fitzgerald, and Scopula (2003) focused on the technology acceptance of groupware in virtual learning teams in part-time adult education and used the data from two different

Masters education programs. Their results have shown that social awareness plays an important role in the acceptance of such technology to support collaboration. On the other hand, some studies addressed public awareness of action strategies and willingness to respond to climate change (Whitmarsh, 2008). They explored awareness and behavior in relation to climate change. As a matter of fact, awareness is reported to be a factor in preserving and improving the quality of the environment (Fielding, McDonald, & Louis, 2008). However, both Bjorn et al. (2003) and Kowalski and Goldstein (2006) pointed the need of further research to validate the role of social awareness. Additionally, according to Jenkin et al. (2011b), limited research has examined the potential of Green IT due to the general lack of awareness of the impacts of IT on organizations' environmental footprints as well as the recent urgency regarding environmental issues. All these lead to following hypotheses.

$H4_1$: LA has significant impact on ATB.
$H4_2$: LA has significant impact on BI.
$H4_3$: LA has significant impact on AB.

3.3. Hypotheses regarding TRA constructs

Issues regarding Information Technology adoption and use is a central concern of information systems research and practice (Venkatesh & Davis, 2000). Although significant effort has been made over the last decade, according to Venkatesh and Davis (2000), understanding and creating the conditions under which information systems will be embraced by the human organization remains a high-priority research issue.

In many cases, substantial theoretical and empirical support has accumulated in favor of conceptual framework usage, which is based on the behavioral intention model, referred to as the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA has been applied to many studies on the adoption and use of innovation and technologies. Information and Communication Technologies is, naturally, one of these fields and some of the example studies in this field can be listed as intention to use a word processing program (Davis, 1989), on-line shopping intention (McCole, 2002), gender diversity in technology usage (Baker, Al-Gahtani, & Hubona, 2007), software piracy (Chang, 1998), etc.

Green IT refers to the use of IT resources in an energy-efficient and cost-effective manner (Bose & Luo, 2011). It has been argued in the literature that IT holds the promise of being instrumental in combating the negative environmental effects of the world's rapidly developing economies (Erek, Schmidt, Zarnekow, & Kolbe, 2009). Over the past few years, green IT strategy, design and practice initiatives evolved gradually into an active research area in the information system discipline, and, presently, there are few empirical researches in the area of green IT (Bose & Luo, 2011). However, in a majority of GIT research to date, there is a lack of social perspective (Erek et al., 2009).

Having considered all these, it seems reasonable to use the TRA in the inspection of determinants of green IT usage and, therefore, following hypotheses are postulated.

H5: There is a significant relationship between ATB and BI.
H6: There is a significant relationship between SN and BI.
H7: There is a significant relationship between BI and AB.

4. Research instrument and data

A survey was conducted to examine the application of extended the TRA to analyse the acceptance of GIT usage (Fig. 1). The data were obtained by means of a questionnaire for this purpose. A pilot version of the research instrument was developed and distributed to a group of people to get their suggestions and clarifications. Several IT managers were interviewed and their suggestions were included in the questionnaire design. The survey contains 17 questions grouped under 6 constructs and in accordance to the TRA inquire data as given in Table 1.

The respondents were the attendees of an annual one-day meeting on issues (problems and developments) in the use of IT in organizations, organized by the Turkish Informatics Association (TIA). The participant organizations were selected from the population of 500 major government and private sector establishments based on the list of TIA (Arifoglu, Kornes, Yazici, Akgul, & Ayvali, 2002). These organizations were assumed to have well established IT divisions in terms of institutional culture, standards, rules and regulations. The "judgement" sampling method (Marshall, 1996) was used to select a sample of 190 establishments considering their size and sector. The judgement sampling is referred to as purposeful sample, since the researcher selects the most productive sample to answer the research question (Marshall, 1996). The sample size significantly represents the population at 10% significance level (Cohen, 1992; Israel, 1992). The sample was limited to IT professionals since GIT is a new concept, and IT professionals are observed to possess a higher level of awareness on the issue compared to other groups in the society (Molla & Abareshi, 2011). This means their data may show more informative pattern than other groups in the society (Jin et al., 2007). Furthermore, Cronan, Leonard, and Kreie (2005) suggested that IT professionals should be concerned to explain the use of IT in business and society because, initially, the developments and implementations are the responsibility of these professionals. The invitations were limited to be one IT representative from each organization. The questionnaire was delivered at the registration desk and participants were reminded to complete the questionnaire by the chairperson of each session several times. A total of 182 completed survey questionnaires were received at the end of the day. Twenty-five responses were discarded from the analysis due to incomprehensible contents. This represents an 82.6% response rate. The tests on the representativeness of the responses in terms of sector distribution of establishments revealed that there is no significant non-response bias (Chi-Sq = 5.397, DF = 1, *P*-value = 0.020).

The reader is referred to Ajzen and Fishbein (1980) and Godin et al. (2008) for the TRA constructs; Ajzen and Fishbein (1980) and Venkatesh (2000) for awareness; Noh (2008) and Whitmarsh (2008) for experience; Jin et al. (2007) and Greaves et al. (2013) for sector of establishments; Young (2008), Jenkin et al. (2011a) and Melas et al. (2011) for person related beliefs.

The Likert Scale is a most widely used and the most effective tool for scaling responses in survey-type studies. It is an ordered, one-dimensional scale from which respondents choose one option that best aligns with their view. In this study, the data was collected using a five-point Likert Scale (5 = very much, 4 = much, 3 = moderate, 2 = little, 1 = very little) for each item (Table 1).

Path Analysis (PA) is one of the statistical methods used to evaluate causal models to find out the relationships between a dependent variable and independent variables. Structural Equation Modeling (SEM) is a general and more sophisticated technique, which has replaced PA in recent studies. SEM is an extension of multiple regression and requires a large sample size as the precision of the estimates is affected by this size (Valluzzi, Larson, & Miller, 2003). Additionally, SEM is mainly confirmatory and used to determine the validity of a model. On the other hand, the regression analysis is one of the most frequently used tools in statistical analysis that can be utilized for confirmatory and exploratory purposes. The theory of regression is well-understood and allows for the formation of different types of easily-interpretable statistical intervals for reliable predictions, calibrations, and optimizations. Additionally, Simple linear regression can work very well for

arbitrary regression problems, especially when sample sizes are small (Pfahringer, 2010). The simplest form of regression is univariate regression, which provides objective measures for the relationships between one dependent (y) and one independent (x) variable, and has been used to analyze the survey data and test the main effects between the constructs as given by

$$y = a_0 + a_1 x$$

To the best of our knowledge, this approach has not been used in the context of GIT in analyzing the relationship between the constructs of extended the TRA. The authors formed 11 regression equations depending on the number of hypotheses in the analysis. The observed scores of coefficients for each of the regression equations have been reported in Fig. 1 for the corresponding dependent variable y. Furthermore, whenever necessary, the chi-square test was also used to examine whether there is a significant relationship between the dependent and independent variables (Milton & Arnold, 2002).

The cronbach's alpha (Brown, 2002) was used to assess the reliability of the constructs (Table 1). The α-values for multi-item constructs of ATB, SN, BI, PRB and LA are 0.850, 0.872, 0.870, 0.815, and 0.829, respectively. Additionally, the overall internal reliability as measured by Cronbach alpha was found to be 0.755. Thus, the survey data exhibits adequate reliability (Yu, 2007). For the establishment of content validity, the items and their corresponding constructs were adapted from prior studies, and modified according to the context of this study. Apart from this, an extensive refinement process was used during the selection of items.

5. Results

5.1. Descriptive results

The demographic profile of male and female respondents is summarized in Table 2. The respondents consisted of 62.4% male and 37.6% female. Most of the males practice GIT at an average level or more (56.45%); this percentage is 55.77% for female respondents. Indeed, gender diversity is not found significant in terms of GIT adoption (Chi-Square = 3.372, DF = 3, P-value = 0.338). This may be because our respondents are IT professionals, and that traditional dominating role of males in the society is not valid in professional environment. Also, males and females are equally likely to share the opportunities and developments, including ICT. Most of the respondents were from public-sector organizations (53.5%). Also, test results do not show a significant difference for the respondents'sector regarding GIT usage (Chi-Square = 1.757, DF = 3, P-value = 0.624). Of the male respondents, 8.2% was above 50 years of age, and those between 31–40 and 41–50 constituted 22.4% and 26.5%, respectively. These percentages are 10.2%, 33.9%, and 16.9% for the female respondents. In general, most of the respondents belong to the group aged less than 30 for both males (42.9%) and females (39.0%). It has been observed that the distributions indicated the highest percentage for those professionals with less than 5 years of experience for males (32.6%) and females (35.6%). The relationship between the level of experience and that of practicing GIT was found to be significant as a result of the chi-square test (Chi-Square = 22.040, DF = 12, P-value = 0.037). Naturally, age and experience show parallel dispersions for both genders.

Table 2
Demographic profile of respondents.

Variable-description	Male (N = 98)		Female (N = 59)	
	N	Percentage	N	Percentage
Sector	98	100.0	59	100.0
1 = public	53	54.1	31	52.5
2 = private	45	45.9	28	47.5
Age	98	100.0	59	100.0
1 = 21–30	42	42.9	23	39.0
2 = 31–40	22	22.4	20	33.9
3 = 41–50	26	26.5	10	16.9
4 ⩾ 50	8	8.2	6	10.2
Work-experience	98	100.0	59	100.0
1 = 0–5	32	32.6	21	35.6
2 = 6–10	24	24.5	13	22.0
3 = 11–15	17	17.4	10	16.9
4 = 16–20	15	15.3	4	6.8
5 ⩾ 20	10	10.2	11	18.7

5.2. Test results

The proposed hypotheses based on the research model were tested individually using the least-squares regression analysis technique, and the pertaining results are given in Fig. 1 along with their perspective path coefficients.

Interestingly, based on the p-values for the external variables stated, Fig. 1 shows that the hypotheses $H1_1$, $H1_2$, and $H1_3$ are all accepted at either 0.001, 0.01, or 0.05 significance levels. This means, among external constructs, PRB has a significant impact on all of the TRA constructs; namely, ATB ($p < 0.001$), BI ($p < 0.01$) and AB ($p < 0.05$), implying individual beliefs have a direct impact on attitude, intention, and actual use of GIT. This effect was observed to be positive, which means, with the increasing level of belief on the environmental effect of IT usage, the IT professionals' intention for the adoption of GIT increases. Similarly, the external construct LA has also significant direct effect on ATB ($p < 0.001$), BI ($p < 0.05$), and AB ($p < 0.001$). This means that IT individuals with more awareness on the environmental effect of IT usage intend to adopt GIT more often.

However, an inspection of p-values regarding the socio-demographic variables produces conflicting results. The sector of the respondents' establishment has an indirect effect on actual GIT usage since it appears to have a significant relationship with the attitude towards behavior. Therefore, hypothesis H2 is accepted at $p < 0.05$. In other words, IT professionals working in the private-sector establishments show more responsible attitude regarding GIT practices than their counterparts in the government sector. This may be taken as an evidence of the notion that IT professionals' use of GIT may be shaped according to the sector of their organizations. Interestingly, the experience of the respondent is not in favor of the hypothesis H3. This means, experience does not have any impact on the behavior towards practicing GIT.

It is also interesting to note that all the hypotheses relating to the TRA variables were supported either for $p < 0.05$ or for $p < 0.001$. In other words, H5, H6, and H7 are accepted. This means that BI was found to be significantly determined by ATB ($p < 0.001$) and SN ($p < 0.001$), which also implies that the attitude towards behavior and subjective norms have a significant impact on behavioral intention at 0.001 significance level in terms of adopting GIT. Similarly, BI determines AB at a 0.05 significance level. This can also be interpreted as the relationship between behavioral intention and actual behavior is statistically significant at 0.05. In other words, behavioral intention has a significant impact on the actual behavior in adopting GIT. All these indicate that the TRA supports the use of GIT and the traditional TRA constructs are determinants of GIT adoption decisions (Mallat, Rossi, Tuunainen, & OOrni, 2008).

Aside from this, all the relations were found to be positive when path coefficients are considered (Fig. 1).

6. Discussion

6.1. PRB versus TRA constructs ATB, BI and AB

This study found PRB to have a positive impact on TAM constructs ATB, BI, and AB. Among these, the effect on BI was more than the others for the adoption of GIT. This finding has also been supported by other studies in the literature (see, for example, Lam et al., 2007; Shih & Fang, 2006). The study by Shih and Fang (2006) is related with customer adoption intentions of Internet banking, and reported that attitudinal belief is a significant determinant of attitude, behavioral intentions, and actual behavior. Lam et al. (2007) also confirmed that perceived IT beliefs significantly influence the attitude of hotel employees in adopting IT. It is interesting to note that all of the stated studies applied the TRA, and that their findings are in line with the present work. Additionally, individual beliefs about human role regarding environmental sustainability leads to wide range of beliefs and attitudes concerning more specific environmental issues (Dunlap et al., 2000). Therefore, individual beliefs constitute a fundamental component of people's belief systems and individual's willingness to take proenvironmental actions in response to new environmental issues (Cordano et al., 2004; Dunlap et al., 2000). These results indicated that respondents, who believe in the environmental effect of IT tend to develop an attitude towards practicing GIT.

Conversely, Pickett-Baker and Ozaki (2008) revealed that values and beliefs concerning environmental issues have no direct links with environmentally responsible behavior. This could stem from the fact that their sample was relatively small (52 respondents), and that the TRA concept was absent in their study.

6.2. SR and ER versus TRA constructs ATB

Studies have been too limited in number in identifying the impact of organizations' sectors and the respondents' experience on the adoption of GIT. However, there are still a number of studies which have explored the influence of organizations' sectors as well as the respondents' experience on the adoption of IT in general.

According to the results of the existing studies, it appears that the respondent's sector influences their attitude towards behavior. For example, Tung and Rieck (2005) found the significance of organization's sector on the adoption of electronic government services among business organizations in Singapore. They concluded that compared to many private-sector organizations, government agencies have been relatively slow in establishing and developing an online presence. In our study, professionals working in private organizations have shown higher positive attitudes in GIT adoption in comparison to the public sector. West and Lu (2009) also observed that private-sector outpaced public-sector on most dimensions of technology innovation. Infact, cost is a dominant determinant in the use of new technologies (Moores & Dhaliwal, 2003) and the income level of IT professionals, generally, in private-sector establishments are higher than that of their government-sector counterparts. Therefore, considering their income level, public-sector professionals probably find that GIT adoption inflicts unexpected costs, and are likely to give higher priority to their basic needs.

Liao and Lu (2008) have suggested that prior experience can be a potential determinant of e-learning website use. They established, by conducting a survey of 137 students of a project management course, that the technology adoption of learners with prior e-learning experience is different from those without prior e-learning experience. This result is inconsistent with our findings since IT professionals' experiences were not found to have any impact on ATB in the adoption of GIT in our study. Although the sample size is not very different in both studies, their results are based on the students' responses – whereas the present study has been conducted with IT professionals. Additionally, as stated before, considering IT professionals, it is not likely to expect differences in adopting new technologies in terms of their experience level. Liao and Lu (2008) considered the impact of past e-learning experience in future adoption of e-learning; whereas the present study examines the significance of past IT experience in the adoption of GIT. Hollenstein (2004) explored the role of experience only in a specific case, where an earlier and a later vintage of technology are clearly linked. He found that experience with "Electronic Data Interchange" favors the adoption of Internet-based e-selling in later years. This is contradictory to the result of the present study, which may be due to the differences in characteristics and the size of samples. Hollenstein's (2004) results are based on the data from 2641 companies in the Swiss business sector, while this study has used a sample of 182 IT professionals from public- and private-sector establishments. Another reason may be sourced by the differences in definition of the experience used in research, such as the number of years spent in an establishment, overall, work experience, IT usage experience, professional IT experience, etc.

6.3. LA versus TRA constructs ATB, BI and AB

This study found the external factor "level of awareness" to have a significant impact on the TRA constructs attitude, intention, and actual behavior in terms of IT professionals' adoption of Green IT. This means IT professionals, who are aware of environmental and GIT issues, do essentially practice GIT when using IT. Furthermore, they find GIT to be easy, essential, and beneficial. They also recognize the importance of considering GIT issues while purchasing new hardware and software. However, based on our results, it seems that professionals are, in a way, pioneers and early adopters of GIT. Although, 56.37% of the respondents reported that they practice GIT, it should be noted that its adoption is not common and that there is chasm in the society regarding this issue.

Some of the existing literature support our findings. For example, in their research on green behavior, Amel et al. (2009) demonstrated that individuals who are more mindful (aware and attentive), report more sustainable behavior. This is probably because mindful individuals are more likely to attend to their surroundings and aware of environmental impacts. Amel et al. (2009) used the data gathered from 100 adults attending a Midwestern sustainability exhibition to explore the connection between mindfulness and sustainable behavior. The sample size is relatively identical in range to the present study. Furthermore, their respondents were not ordinary public and more aware of environmental issues – just like the ones in the present study, where the respondents are IT professionals.

The literature is not conclusive in this respect and Do Valle et al. (2004), for example, found no relationship between awareness and actual behavior. They found that both household recyclers and non-recyclers have a similar awareness level. Do Valle et al. (2004) conducted a nationwide survey and their results are inconsistent with the results of the present study due to larger sample size and variety. Mitomo and Otsuka (2012) noticed that although people are exposed to a variety of information on an ecological way of life and that such exposure could contribute to an increased awareness of the global environment, their behavior may not be as environment-conscious as expected. This can be attributed to factors, such as limited memory retention, projection bias, and urgency of the problem, which are major concepts in behavioral economics. Therefore, they recommended that people should be exposed to environment-related information continuously so that they are less likely loose awareness.

6.4. Relationship among the TRA constructs

Attitude towards behavior (ATB) and subjective norms (SN) have a strong positive effect on the behavioral intention of IT professionals in the adoption of GIT, and their path coefficients are the highest of all. However, ATB (path-coeff = 3.83) has a slightly greater impact than SN (path-coeff = 3.43) in determining behavioral intention. This is supported by Chow and Chen (2009) in their work examining the beliefs and behaviors of IT users in green computing. They also found that ATB is a more dominant factor than SN in determining the intention to practice green computing. Our results reveal normative and attitudinal pressure toward the use of GIT since these factors are used to explain the rapid adoption of technology (Bhatti, 2007). This shows the importance of the role of IT professionals to consider the social context for the rapid adoption of GIT (Nysveen, Pederson, & Thobjornsen, 2005).

In their research, Lien, Huang, and Chang (2012) studied green consumption cognition and behavioral intentions of consumers in the restaurant industry, and observed that attitude and subjective norms have significantly positive impacts on their behavioral intentions. Further, Lam et al. (2007) also supported this result in adoption of IT among hotel employees in China. A recent study by Teo and van Schaik (2012) also concluded that attitude has the most dominant effect on behavioral intentions compared to subjective norms. Shih and Fang (2006) partially supported that although attitude is a significant determinant of behavioral intention, subjective norms are not. All the above-mentioned studies except Lien et al. (2012) have applied the TRA whereas Lien et al.'s (2012) study is based on the theory of planned behavior (TPB). The absence of a relationship between subjective norms and behavioral intention in Shih and Fang's study may be due to their field, which is customer adoption intentions of internet banking. Direct interaction with Internet banking, with the customer actually in doubt, creates unusual security risks for transaction fraud, loss, or theft of vital information (Shih & Fang, 2006). Therefore, even the perceptions of people, which are important to customers, could not influence the behavioral intention of the customers to adopt internet banking due to these security risks. Another reason may be based on the study of Tang and Farn (2005). They pointed out the role of culture in using IT, and stated that culture influences preferences, and that there are differences among various cultures from the HCI (Human Computer Interface) point of view (Tang & Farn, 2005). Cakir, Bichelmeyer, and Cagiltay (2002) is also a supporter of this view by stating that cultural tendencies lead to shaping the use of IT.

This study further observed that behavioral intention positively influences the actual behavior. IT professionals with positive intentions towards GIT issues are actually practicing it in their work. This has been supported by Chow and Chen (2009) along with Shih and Fang (2006), who stated that behavioral intention is a significant determinant of actual usage.

7. Implications and conclusions

The study has several implications for researchers and practitioners. In terms of research, it addresses the call for a body of IS empirical research that studies the factors influencing acceptance of green information technologies (Dedrick, 2010; Melville, 2010). The study, therefore, represents one of the few empirical studies regarding the acceptance of GIT among IT professionals. The paper also determines the factors that contribute to the beliefs and behaviors of IT professionals towards adoption of GIT in organizations. These findings can be helpful to researchers and practitioners attempting to understand IT professionals' beliefs and behaviors in GIT acceptance.

According to the results of this study, the sector – public or private-of individuals' workplace influences their attitudes towards behavior in GIT acceptance. It seems that bureaucratic procedures in the adoption of new technology may be a constraint for the professionals in government-sector establishments. Due to resource limitations, professionals in private sector establishments generally use their resources in an optimum way and they are ready to employ innovative ways and technologies which facilitates in this direction.

This study could not find any relationship between prior experience and GIT adoption. As an IT professional, a person is deemed to have a basic knowledge of IT, and experience of a few or more years may not necessarily influence their decision to adopt GIT. Contrarily, if the sample consists of common citizens or students, then their past experience of using a particular technology may significantly affect its future adoption. The present study also found that the level of awareness has a significant impact on attitude, intention, and actual behavior in adopting GIT. Organizations can complement employee responsibility to environmentally-friendly practices by disseminating environment-related information within the organization to increase their awareness which may lead to adoption of GIT practices.

In the study, it has been observed that IT professionals who felt that practicing GIT is necessary, convenient, and valuable consider GIT issues while purchasing hardware and software. The perceptions and actual behavior of people, considered important by IT professionals, may influence them to consider GIT issues while making decisions to purchase a hardware and software. Also, the significant influence of subjective norms on IT professionals' behavioral intentions reveals that people, who are considered important by IT professionals, should be expected to provide motivation for the adoption of GIT. This study also discovered that a significant relationship exists between behavioral intentions and the actual behavior in the adoption of GIT in organizations.

This study uses a survey approach for the purpose of investigating the adoption of GIT practices. The data was collected using a sample of IT professionals since GIT is a relatively new concept and these professionals are likely to be more aware of GIT issues. For the analysis, the conceptual predictive model TRA was used and the factors incorporated in the analysis were selected with due consideration of the elements of this model. These factors can be listed as ATB, SN, BI, and AB. The model was also extended to include four external variables as PRB, SR, ER and LA. According to the test results, the TRA is in favor of GIT adoption. This is also true for external factors considered in the analysis. This means, all the external factors, except SE, were found to have a significant effect in the adoption of GIT.

This study possesses some limitations. First, the generalizability of the results may be limited due to the data collection method, which was based entirely on how the participants have perceived their practices towards GIT. Replacing such data-gathering techniques with interviews can lead to a better probing of the responses in the future efforts. Second, this study considered the relationships between perceptions/behaviors towards GIT among IT professionals. Therefore, an extension to consider the impact of the working environment on practicing GIT in organizations from different sectors would also be of interest. In this respect, the influences imposed by the group under analysis, as well as factors regarding administration in different firms, may also provide additional interesting results. Final limitation, as addressed by Calhoun, Teng, and Cheon (2002), Chirkov, Ryan, and Kim (2003), and a number of others, is related with the significant impact of culture in using ICT. As such cultural, social, geographical, and economic factors deserve a closer look in terms of their impact on organizational, as well as personal, perspectives in practising GIT.

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