International Journal of Enterprise Information Systems
Volume 13 • Issue 4 • October-December 2017

Green Information Technology Usage:
Awareness and Practices of Philippine IT Professionals

Alexander A. Hernandez, College of Information Technology Education, Technological Institute of the Philippines, Manila, Philippines

ABSTRACT

Green information technology is resource efficient and effective consumption through the use of IT infrastructures to address environmental sustainability. This study aims to understand the level of awareness and practices of IT professionals towards GIT in organizations. A survey questionnaire was used, the study found that participants have a high awareness and practices of Green IT covering the efficient use of computing resources, energy conservation in an office environment, responsible disposal of electronic wastes, and demonstrate an individual contribution and commitment to GIT adoption practices in organizations. The study also found that male IT professionals have better awareness of GIT in organizations. The awareness and practices of IT professionals in GIT offers direction for organizations to strategically integrate GIT within their core business objectives and activities to attain environmental sustainability. Practical and theoretical implications are presented.

KEYWORDS

Awareness on Green IT, Green IT, Practices on Green IT, Sustainability

1. INTRODUCTION

Green IT is the study and practice of environmentally sustainable computing in organizations. It is an approach to address the growing environmental challenges resulting in detrimental effects to natural resources, increased carbon emissions, and leads to global warming (Bengtsson and Ågerfalk, 2016). These problems are associated with business activities heavily relying on the use of IT. Thus, it resulted in the inception of Green IT (GIT). The goal of GIT is to achieve resource-efficient and low-carbon business activities to minimize its impact on the environment (Loeser et al., 2017. Therefore, GIT remains a significant area of both research and practice.

Previous studies suggest that knowledge of new technology is critical to further technology adoption in organizations (Jenkin et al., 2011; El Idrissi and Corbett, 2016). It is also necessary to understand the role of professionals in the adoption of GIT in organizations and become an integral element of their work culture. Recent information technology (IT) infrastructure spending is crucial to achieving business performance (Chuang and Huang, 2016), however, as this grows, behavioral change among IT professionals is perceived significant to achieve sustainable use of computing resources (Murugesan and Gangadharan, 2012). Therefore, IT professionals have an

DOI: 10.4018/IJEIS.2017100106

important role to play in achieving environmental sustainability through their awareness of and practices in GIT in organizations.

The immense perspective to establish the practices of IT users helps to achieve environmental sustainability. More recently, GIT is a global issue for various industries. However, it is also growing concern in developing countries in which lacking educations is observed. The developing countries have been slow in recognizing environmental sustainability concerns and challenges (Hernandez and Ona, 2016; Chugh et al., 2016) in comparison to developed countries with advanced strategies, policies, and technology implementations on GIT. Therefore, developing countries have a significant role to play in GIT adoption (An Hign et al., 2017). It also calls for an urgent introduction to GIT, and take essential actions to engage and increase awareness of employees in organizations.

To date, studies on exploring the awareness of employees in GIT and practices are mostly focused in developed countries. However, a handful of studies investigating this phenomenon in developing countries such as the Philippines is not evident in the literature. Considering the growing economy and population of the country, therefore, this study attempts to fill this gap and offer new insights on GIT awareness and practices of IT professionals, which could be integrated as part of IT professionals' roles in achieving environmentally sustainable work practices in organizations.

This study aims to present the findings of a survey that explores the environmentally sustainable practices by Philippine IT professionals. To attain the goal of the study, a survey was used to determine the level of awareness and practices in GIT among IT professionals. The remaining parts this research covers the following sections: (2) discussions on the roles of IT professionals in environmental sustainability and overview of the Philippine IT industry, (3) discussion of the research method and considerations in adopting a survey instrument, (4) the results of the study and presentation of findings, (5) discussion of the theoretical and organizational contributions and lastly (6) the conclusions and research limitations are discussed.

2. LITERATURE REVIEW

2.1. Overview of the Philippine IT Industry

As of 2016, the total IT companies in the Philippines was at an average of 646 with different business activities supporting local and international customers (IBPAP, 2016). Moreover, the IT sector continues to grow due to the international demands and developing economies. In 2015, the IT sector posted USD 22 billion in revenues, thus, making it the second largest source of income in the Philippines (Magkilat, 2015) and accounts for 9% of the gross domestic product in 2016 (IBPAP, 2016). The IT sector labor market and productivity increased by 1.2 million direct jobs. The stable growth of the IT sector is attributed to the foreign direct investments, the numerous expansions and projects in the past five years (Manning et al., 2016). Recently, the IT sector encourages partnership with government agencies and academe to harness research and development (Hernandez and Ona, 2015), co-develop industry champions and participate in environmental sustainability programs. Similarly, the IT sector embarked to greener business activities such as GIT as one of the focus areas for rapid growth and sustainability (Department of Information and Communications Technology, 2016). Specifically, the professional associations and organizations in the IT sector developed GIT roadmap and strategy together with the design of guidelines on its implementation (Hernandez and Ona, 2016). Overall, through GIT, the IT sector contributes to achieving a more sustainable business and environment.

2.2. Roles of Information Technology Professionals in Environmental Sustainability

The Philippines Information Technology-Business Process Management (IT-BPM) sector experience sustained growth in the last five years (Department of Information and Communications Technology, 2017), however, as an indirect result, greengas house emissions and energy consumption continuously rise (Department of Science and Technology, 2013). These results contribute to the long term environmental degradation. Thus, organizations in the Philippines proactively adapt to GIT and sustainable practices as IT infrastructure continues to grow (Komatsuzaki, 2016) in many industries. Santiago (2013) reported that GIT and sustainability initiatives spending in the Philippines would reach USD 2.5 billion by year 2020. It manifests the gap in GIT and sustainability adoption and slower as compared to other developing countries as Philippine organizations lack strategic directions and approaches to further GIT adoption (Deloitte, 2015). Moreover, major problems and issues confronting the Philippines on sustainable environment from an IT perspective covers (a) rising electronic waste (Terazono et al., 2017), (b) ignorance (Roumasset et al., 2016), rising energy costs (Roxas and Santiago, 2016), (d) increasing carbon footprint (Holden et al., 2017), and depletion of natural resources (Khan et al., 2016).

These problems prompt serious threat to environmental sustainability, public health and safety, thus, a strategic approach is necessary to address these problems (Lee et al., 2013; Khor et al., 2015; Terazono et al., 2017). The establishment of GIT based strategic business approach, guidelines, integration of IT infrastructure, and systems are critical in the primary business procedures of an organization to achieve resource-efficiency and effectiveness and reduce environmental footprint (Montabon et al., 2016). The goal of GIT is to address technology inefficiencies essentially, focus on searching for available best options, and more effective strategies. Environmental sustainability may be referenced alongside different measures, but, in the perspective of GIT, it is commonly concentrated in the reduction of energy consumption in the entire business lifecycle (Deng and Ji, 2015), decreasing greenhouse gas emissions, better environmental knowledge and governance (Mithas et al., 2010), the usage of technology efficient equipment, and electronic waste reduction from IT industry (Luthra et al., 2014). Prior works proved that GIT adoption reduces costs (Tseng et al., 2013; Harmon and Auseklis, 2009; Chitra, 2011). It can also increase profit by 45% of organizations (Gullo and Haygood, 2010). Considering GIT adoption is an essential aspect in addressing sustainability associated concerns. Similarly, Hilty and Aebischer (2015) stated that IT use can positively persuade environmental concerns. However, the beneficial outcomes of GIT adoption were recognized concerns worthy of further investigation.

Disposal of IT waste responsibly is a significant measure towards encouraging environmental sustainability (Afroz et al., 2012). Electronic waste can come from used and damage electric and electronic devices that reached the end of life. The IT industry contributes 36% of electronic wastes generated in the Philippines (Terazono et al., 2017). Thus, electronic waste is now a major concern both in quantity and toxicity in nature (Li et al., 2017). Most organizations and households are unaware of responsible electronic waste disposal schemes, except for firms with in-placed waste management policies (Yoshida et al., 2016). In support of this growing problem, managerial support and commitment, and organizational culture hinder environmentally friendly practices (Zaman and Sedera, 2016). Therefore, investigating the practices of IT professionals as well as organizations perspective with the sustainable environment could promote responsible electronic waste disposal within the IT industry.

The IT industry generates nearly 740 million metric tons of carbon emissions annually (Gelenbe and Caseau, 2015) in which carbon footprint also increases (Kanemoto et al., 2016). Hence, IT professionals can take the initial step to reduce carbon footprint in their organizations. The continuous growth of IT industry in the Philippines has led to the growing IT practitioners in the industry. The Philippines employs nearly 1.2 million of IT professionals working in IT-BPM industry (Hernandez and Ona, 2015). Considering the growing number of employees, it is essential to introduce awareness on GIT practices as to further GIT adoption in organizations (Hernandez and Ona, 2016). The IT

industry is largely consuming energy and engaged in maintaining related products in various sectors (Hernandez and Ona, 2016). Hence, the practices IT employees adopt can have implications on environmental sustainability. The behaviors of IT employees also constitute an essential enabler on sustainable environmental practices. Moreover, GIT awareness emerged significantly in different industries (Makela and Luukkainen, 2013). Given the employees' awareness of GIT, it signifies a real foundation of change in behaviors with a greater focus on environmental sustainability (Baggia et al., 2017). Employees can take action and influence others to adopt GIT practices by changing some of their existing IT activities (Gan et al., 2017). However, GIT adoption practices are limitedly discussed in the literature (Loeser et al., 2017). It presents the necessity to adopt further GIT practices through the IT professionals' uptake through their knowledge and ability to apply these practices. Hence, investigating the level of sustainable computing knowledge remains an important aspect of information systems research and practice.

A key driver of sustainability investments within firms was employees' knowledge, support, and commitment towards sustainable computing practices (Yang et al., 2017). Front liners including employees and managers were considered crucial in adapting to sustainable computing activities (Al-Shemmeri and Naylor, 2017). Molla et al. (2014) in their study of IT professionals found that more concerns were focused on rising environmental challenges and their positive perspective about GIT. It was also concluded that it professionals were gradually changing their behaviors on GIT through paper-saving activities, however, in doubt of firm's awareness, practices, and policies on GIT. In a study of Philippine IT professionals to determine the significance of environmental issues, 35 percent of the respondents indicated that environmental sustainability was incorporated into their business activities (Hernandez and Ona, 2016). However, GIT is missing from the employees' perspective. Conversely, there were some sustainability practices covering switching off unused computers (Hernandez and Ona, 2016) and 3R (recycle, reuse, reduce) (Widjaja et al., 2011; Terazono et al., 2017), reducing the brightness of desktop displays (Chow and Chen, 2009), and common understanding about sustainable computing practice (Watling and Zhou, 2011) as well as reducing printed business documents.

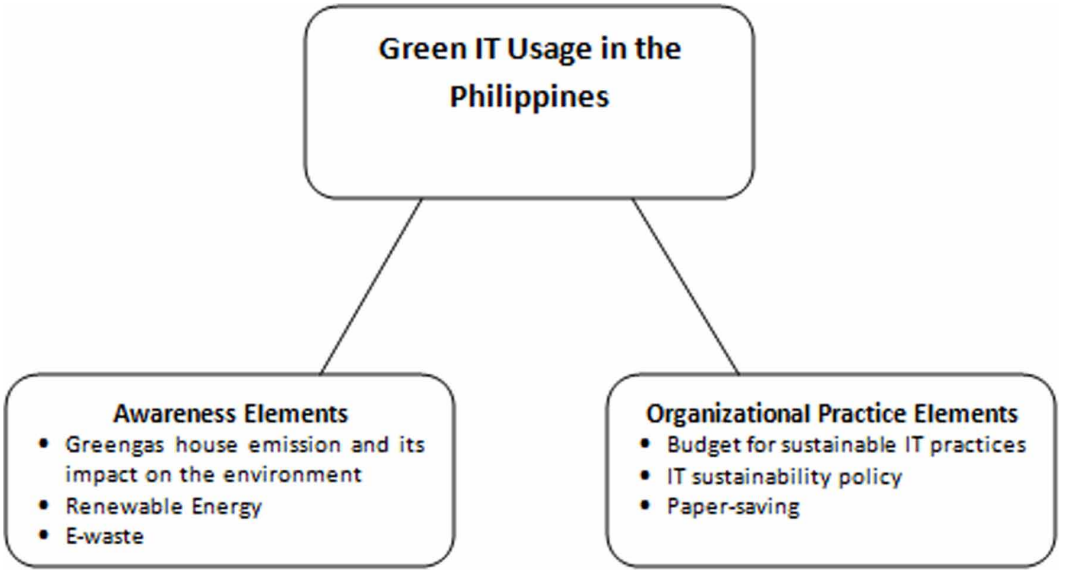
The main point of the literature review highlights the concerns on sustainable computing activities. These issues and challenges were investigated comprehensively, thus, mostly conducted in developed nations, covering small to large scale organizations (Weng and Lin, 2011; Zailani et al., 2014; Abdullah et al., 2014; Cuerva et al., 2014, Lim et al., 2015), however, as stated in the introduction, a handful of studies have been available in the literature exploring the environmentally sustainable practices of IT professionals in the Philippines. Hence, this research explores on both awareness and practice as there is little work in this area despite the critical roles of IT practitioners in the design, manufacturing, use, and disposal of IT infrastructure and related systems.

Finally, this study aims determine the green behaviors (Jenkin et al., 2011) of IT employees (Murusegan and Gangadharan, 2012) in a developing country perspective (Lee et al., 2013), by specifically exploring awareness (Chuo and Chuo, 2012) and practices in GIT (Seidel et al., 2010). Figure 1. presents the awareness of and practices in GIT of Philippine IT professionals. The components identified were from the previously discussed literature review in the section.

3. METHODOLOGY

The purpose of this research is to determine the level of awareness and practices of Philippine IT professionals towards GIT. The succeeding sub-sections discuss the survey questionnaire, demographic profile of the participants and data collection activities. This study used a validated survey questionnaire from the literature with three sections and sixteen items (Chugh et al., 2016). The questionnaire uses Likert's scale using a five-point scale for awareness and GIT practices with categories such as (a) demographic information, (b) awareness of environmental sustainability and (c) environmentally sustainable practices adopted by respondents and their organizations.

Figure 1. Green IT awareness and practices of Philippine IT professionals



The survey questionnaire was distributed to thirty-eight firms of different sizes. The respondents were invited to participate through an email sent to the firm's IT manager containing the web survey link. The data was gathered from October – December of 2016. The survey was distributed to IT professionals as they were considered as knowledge workers (Gullo and Haygood, 2010) and were involved in GIT practices at the professional and individual level. The IT professionals were also considered as they were users and driver of GIT initiatives. Purposive and snowball techniques were used to ensure that the respondents were only IT professionals of different participating organizations. The IT managers were requested to distribute the survey to the selected IT professionals and encourage them to submit a completed survey. However, the identities of the respondents were not solicited from these organizations.

The survey questionnaire was sent through email with 108 completed survey received and only 104 were considered usable. Considering the exploratory and initial research on environmental sustainability awareness and practices, this study analyses IT employees' awareness regarding GIT practices from a chosen group of thirty-eight companies. It is considered that the selected group of IT professionals was valid representatives of the IT sector in the Philippines. The demographic characteristics of the IT professionals are presented in Table 1.

4. RESULTS AND DISCUSSION

Table 2 presents the mean score of the survey among all age groups; the results indicate that age group thirty-five and older are more aware of emissions and implications to the environment. Likewise, they perceived greater importance in renewable resources and understanding on electronic waste. Also, the results indicate age group thirty-five and older have higher agreement on their responsibility to act on environmental issues. However, age group twenty to twenty-four have a higher awareness of the increasing costs of energy use of IT equipment, and consistent on turning off computers after office hours. Meanwhile, all age groups have almost similar awareness in switching-off lights. The results also show that thirty-five and older have noted that their organizations have sustainability policy, and employ an in-charge for sustainable practices, and put emphasis on paper-saving activities.

Table 1. Demographic profile of IT professionals

Characteristics	N (%)
Age – Group	
20-24 25-29 30-34 35 and older	15 (14.42%) 41 (39.43%) 26 (25%) 22 (21.15)
Gender	
Male Female	79 (75.96%) 25 (24.04%)
Number of Employees in the Firm	
Less than 1000 More than 1000	48 (46.15%) 56 (53.85%)

Table 2. Comparison of the mean score among age groups

Statement	Age Group				
	20-24	25-29	30-34	35 and Older	Average
I am aware of greenhouse gas emissions and its impact on the environment	3.4	3.3	3.5	3.6	3.5
I am aware of renewable energy	3.3	3.7	3.5	3.8	3.6
I have knowledge of e-waste	2.6	3.1	3.2	3.4	3.1
I take responsibility to assist in making a difference on environmental issues, for instance, energy consumption and e-waste disposal	3.1	3.2	3.5	3.7	3.4
I am aware of the increasing cost of energy consumption in desktop computers	3.3	3.1	3.3	3.2	3.2
I shut down my personal computer after work day.	3.6	3.2	3.1	3.1	3.3
I switch-off lights when not be used.	3.5	3.7	3.5	3.5	3.6
My company provides budget for sustainable IT practices	3.0	3.5	3.3	3.5	3.3
My company has an IT sustainability policy	3.1	3.3	3.2	3.5	3.3
My company has a dedicated person responsible for ICT sustainable practices	3.5	3.4	3.5	3.6	3.5
My company highlights paper-saving	3.3	3.6	3.4	3.7	3.5

Based on the results of the survey (see Table 3), the comparison between male and female groups has little difference in most of the items. Both male and female groups have similar agreement on shutting down of computers when not used in their firms, allocates budget for sustainable IT practices, and highlights paper-saving activities. The male group had a higher awareness of renewable resources, considers individual responsibility on sustainable environment challenges including electronic waste disposal, switching-off lights, and energy use of equipment. The male group also recognized the relevance of sustainable ICT guidelines and considered designating a member of the organization to further GIT practices. Therefore, it could be explained that male professionals observed better understanding and awareness of sustainable environmental practices

Table 3. Comparison of the mean score among the genders

Statement	Gender	
	Male	Female
I am aware of greenhouse gas emissions and its impact on the environment	3.7	3.5
I am aware of renewable energy	3.8	3.4
I have knowledge of e-waste	3.6	3.2
I take responsibility to assist in making a difference on environmental issues, for instance, energy consumption and e-waste disposal	3.3	3.5
I am aware of the increasing cost of energy consumption in desktop computers	3.5	3.3
I shut down my personal computer after work day.	3.9	3.3
I switch-off lights when not be used.	3.7	3.4
My company provides budget for sustainable IT practices	3.3	3.3
My company has an IT sustainability policy	3.8	3.2
My company has a dedicated employee responsible sustainable IT practices.	3.8	3.6
My company highlights paper-saving	3.5	3.5

and proactive behavior. Overall, GIT practices among female and male groups were similar within the organizations involved in this study.

The results of the survey present (see Table 4) the comparison between two groups: organizations with less than one thousand employees and organizations with more than one thousand employees. Overall, organizations with less than one thousand professionals have lower GIT practices covering (a) greenhouse gas emission, (b) consideration of renewable resources, (c) electronic waste understanding, (d) individual responsibility and contribution to addressing environmental challenges, and (e) issues

Table 4. Comparison of the mean score among different size of organizations

Statement	Size of the Organization	
	Less than 1000 Employees	More than 1000 Employees
I am aware of greenhouse gas emissions and its impact on the environment	3.1	3.4
I am aware of renewable energy	3.1	3.5
I have knowledge of e-waste	3.0	3.2
I take responsibility to assist in making a difference on environmental issues, for instance, energy consumption and e-waste disposal	3.1	3.7
I am aware of the increasing cost of energy consumption in desktop computers	3.0	3.4
I shut down my personal computer after work day.	3.1	3.5
I switch-off lights when not be used.	3.3	3.9
My company provides budget for sustainable IT practices	3.1	3.4
My company has IT sustainability policy	3.1	3.4
My company has a dedicated employee responsible sustainable IT practices.	3.5	3.4
My company highlights paper-saving	3.2	3.8

on the rising energy use of IT equipment. It is also observed that most of these organizations have a lower budget for IT practices, sustainability policy. The results also indicate that organizations with more than one thousand employees have an emphasis on the importance of switching-off lights, and paper-saving activities as an element of sustainable practices as compared to smaller organizations.

5. THEORETICAL IMPLICATIONS

This paper provides a significant contribution to the Green IT literature. First, it is evident that a handful of studies are available investigating the awareness and practices on environmental sustainability among Philippine IT professionals. Prior studies were essentially persistent to understanding the factors and practices on applying information technology to enhance corporate environmental sustainability (Hernandez and Ona, 2015), however, lacks further exploration on understanding employees' perception regarding their role in sustainability through GIT adoption. This study offers new insight on the awareness, perception, and practices of Philippine IT professionals towards sustainability. The results of the survey suggest that 89% percent have good or very good awareness regarding emissions and its environmental impacts. This understanding relates to firms attempts to adapt to sustainable environmental programs. Likewise, if employees are aware of GIT practices, then, these could be more adopted by the IT professionals and become optimistic to further GIT efforts (Mariani and Imam, 2012).

Second, a handful of studies on GIT practices in developing countries, such as the Philippines, in which IT spending by firms constantly increased. To the date, the IT industry of the Philippines constantly contributes to carbon emissions due to the increasing investments in IT infrastructure. Investigating the Philippine IT professionals GIT practices can offer essential perspectives that can assist in developing much significantly needed GIT practices for Philippine IT organizations. A study suggests that knowledge of IT professionals on GIT practices contributed to addressing environmental issues (Molla et al., 2014). It also suggests that sixty-nine percent of respondents had a fair, good or very good awareness to make a difference on the environment.

Third, male employees exhibited higher awareness and understanding of sustainable environment challenges and their responsibility towards addressing these concerns. Nonetheless, both male and female groups have largely similar adoption of environmentally sustainable practices. These findings are in contrast with Molla et al., (2014) which found both male and female groups were similarly aware of GIT practices, and its significance to attaining environmental sustainability.

The results of the survey also indicate that nearly fifty percent of the respondents signified concern in the increasing resources needed for desktop and server energy consumption. The rising electricity cost is a result of suppliers' imposition of additional electricity charges. However, there is an extent of reducing these costs through environmentally sustainable practices through shutting down of computers when unused and switching off lights after working hours. It is expected that firms must design relevant policies and guidelines to further GIT adoption. However, these organizations need to be GIT champions to spur the adoption of these practices by the employees (Antonioli et al., 2013). However, the results indicate that only forty nine percent of the respondents had dedicated an employee to oversee GIT practices within their organizations. Assigning a dedicated employee could further improve GIT adoption practices among IT professionals in organizations.

To date, the Philippine spending on GIT is not yet formalized as part of the national budget (DTI, 2017). This situation also reflects the commitment of organizations to allocate financial budget for GIT adoption, however, the results also indicate an average of 3.4 mean score which suggests that a few organizations in the Philippines have allocated budget to further the adoption of GIT. Therefore, lacking budget is a major concern in some organizations in the Philippines. However, the results also indicate that only seventeen percent disagreed that their organizations have allotted budget to support GIT efforts. It reflects that firms may have allocated some budget, however, but these were

not promoted effectively within the firms. Hence, requires a new way to encourage budget spending to adopt these GIT practices continuously.

This research opens new opportunities for employees to further GIT adoption within organizations. It also emphasizes the need to develop a framework to apply GIT practices. Lastly, this paper offers new insight into the awareness of Philippine IT professionals on GIT adoption. This work will build on the growing appreciation of firms on GIT adoption as an area of research and practice of environmental sustainability within organizations. The outcomes of the research could be used to promote the proactive participation of employees on GIT practices, therefore, as this research considered a multidimensional construct of investigating Philippine IT professionals practices and awareness level of GIT, and support future researches in this area.

5.1. Organizational Implications

The study suggests that IT professionals employed in large firms in the Philippines have better awareness and knowledge of GIT practices. The findings of this study are consistent with Ansari et al. (2010) about GIT awareness and practices in Bangladesh. Although organizations aim to adapt to GIT practices, however, employees need sufficient knowledge to adopt and may lead to better participation. Hence, small organizations need to provide capacity building and education programs to their employees on GIT adoption including awareness in carbon emissions, responsible electronic waste disposal, and use of information systems to integrate roles in GIT adoption practices.

The role of an economic, social and environmental partnership is critical to the success of GIT adoption in firms (Stankeviciute and Savanneviciene, 2013). Although capacity building equips employees about GIT adoption, it cannot always assure individual participation. Previous studies suggest that culture and individual's attitude remains a barrier and hinder GIT adoption. The study of Gholami et al. (2013) found that managers have an important role to play in adapting to GIT practices. Similarly, the lack of managerial support becomes a significant barrier to the successful GIT adoption in organizations (Buchalcevova and Gala, 2013). Prior studies suggest that innovative culture is attained from top managers to entry level employees, hence, senior managers attitude and ability to persuade employees on GIT practices (Guerci and Pedrini, 2014; Robbins et al., 2014). Certainly, there is the potential of changing the firms' culture and modify individual's actions (Robbins et al., 2014) by developing appropriate GIT guidelines. Conversely, it requires better managerial support, commitment, and responsibility. Organizational policies can spur positive actions to managers going to the staff to motivate them to proactively contribute to sustainable business and environment improvements (Guerci and Predini, 2014).

Despite the implementation of policies, procedures, and facilities to further GIT adoption in organizations, this study also found the lacking budget allocation towards GIT practices, which also come backs with managerial support and behavior. Also, rewards and incentive systems can play a critical role in employees' behavior to continue adopting GIT in organizations (Lim et al., 2013). Likewise, rewards and incentive programs can result in positive implications on enhancing employees' participation in GIT adoption. Interestingly, the results of the survey indicate an equal awareness of GIT adoption and knowledge on sustainable practices among age groups. However, Philippine IT professionals thirty-five and older had better knowledge and awareness of GIT practices and responsibility on environmental issues. This finding is consistent with Molla et al. (2014). Nevertheless, it is an important finding that younger IT employees in developed countries such as Australia are involved with GIT adoption activities than older IT employees.

6. CONCLUSION AND FUTURE WORK

GIT adoption practices play a critical role in spurring environmental performance, however, may not warrant positive outcomes. Conversely, this can be attained by developing appropriate policies and education program aiming to improve the rate of participation and roles of employees, thus,

achieving the goals of environmental sustainability. Prior studies found the significance of individual's understanding can influence in enhancing the rate of participation towards GIT. Hence, it presents the necessity to determine the awareness level that can be useful to develop strategic approaches for engaging employees to implement environmentally sustainable business activities. This study is the first to offer insights on exploring the awareness and environmental sustainability of IT employees in the Philippines and presented deeper understanding and perception regarding GIT adoption practices. The insights presented from this research can offer direction in encouraging and developing practices to sustain GIT adoption in Philippine IT organizations.

This study used a survey to understand the awareness level on GIT adoption practices of Philippine IT professionals. The findings suggest conclusion which can be valuable to firms in designing strategies, guidelines, programs, are presented. First, this study found that IT professionals aged thirty-five and over have a higher understanding of environmentally sustainable practices as compared with other age groups. Significantly, employees aged twenty to twenty-four have lower awareness of GIT practices. The awareness gap between age groups can be explained through the length of stay and experience in IT and their organizations.

This study also offers new insights on GIT practices to achieve environmental sustainability and also recognize the need for further research. Furthermore, IT professionals with prior understanding in regards to GIT adoption can significantly contribute by introducing changes and encourage other employees to adopt by sharing and communicating their positive experience, insights, and outcomes. Also, promote the significance of adopting to GIT practices to attain environmental sustainability within their peers. The study also found that male IT professionals had better awareness on environmentally sustainable practices. However, both male and female groups had a largely similar adoption rate of GIT within their firms.

Lastly, organizations with one thousand IT professionals and above have advanced awareness on the sustainable environment compared to smaller firms. It is also found that firms with one thousand IT professionals have a greater emphasis on shutting down of unused computers, switching off lights and paper-saving initiatives as part of their sustainable environmental practices as compared to smaller organizations involved in this study. This work suggests that smaller organizations are laggard in GIT practices education drive, as employees are the asset of the firms. Therefore, it is necessary to provide sufficient education for them to realize the potential and beneficial outcomes of adopting to environmentally sustainable practices.

Although this study offers new insights about the awareness of Philippine IT professionals on environmentally sustainable practices, this study is not also free from limitations. First, the study only covered Philippine IT professionals, which lacks a global opinion. Hence, the findings and suggestions from this study are only applicable to Philippine IT firms or countries with similar characteristics. This research suggests further studies on exploring the knowledge of IT professionals in several developed and developing countries. Second, this study is based on a survey of respondents of only in IT organizations, future studies can deal with a large number of respondents across sectors and industries in which different insights can be obtained and can assist in designing new strategies and policies to achieve a low-carbon economy, thus, resulting in sustainable business and environment. Finally, exploring the experience of IT professionals through qualitative studies could further reveal meaningful insights in GIT adoption in organizations.

ACKNOWLEDGMENT

The author gratefully acknowledges the constructive and helpful comments of three anonymous reviewers and associate editor on the earlier version of the manuscript which helped to improve the presentation of the article considerably.

REFERENCES

Abdullah, M., Zailani, S., Iranmanesh, M., & Jayaraman, K. (2016). Barriers to green innovation initiatives among manufacturers: The Malaysian case. *Review of Managerial Science*, *10*(4), 683–709. doi:10.1007/s11846-015-0173-9

Afroz, R., Masud, M. M., Akhtar, R., & Duasa, J. B. (2012). Public environmental awareness and performance in Kuala Lumpur city, Malaysia: A case study on household electrical and electronic equipment. *Environment & Urbanization Asia*, *3*(2), 385–396. doi:10.1177/0975425312461100

Al-Shemmeri, T., & Naylor, L. (2017). Energy saving in UK FE colleges: The relative importance of the socio-economic groups and environmental attitudes of employees. *Renewable & Sustainable Energy Reviews*, *68*, 1130–1143. doi:10.1016/j.rser.2016.08.004

An Hign, D., Gholami, R., & Shirazi, F. (2017). ICT and environmental sustainability. *Telematics and Informatics*, *34*(4), 85–95. doi:10.1016/j.tele.2017.01.001

Ansari, N. L., Ashraf, M. M., Malik, B. T., & Grunfeld, H. (2010, June). Green IT awareness and practices: Results from a field study on mobile phone related e-waste in Bangladesh. In *Proceedings of the 2010 IEEE International Symposium on Technology and Society (ISTAS)* (pp. 375-383). IEEE.

Antonioli, D., Mancinelli, S., & Mazzanti, M. (2013). Is environmental innovation embedded within high-performance organisational changes? The role of human resource management and complementarity in green business strategies. *Research Policy*, *42*(4), 975–988. doi:10.1016/j.respol.2012.12.005

Baggia, A., Brezavšček, A., Maletič, M., Šparl, P., Raharjo, H., & Žnidaršič, A. (2016). Awareness and Attitude Towards Green IS in Slovenian Enterprises. *Organizacija*, *49*(1), 15–27. doi:10.1515/orga-2016-0001

Bengtsson, F., & Ågerfalk, P. J. (2016, August). Sustaining Sustainability: Investigating the Long-Term Effects of a Sustainability Initiative. In *Proceedings of the Scandinavian Conference on Information Systems* (pp. 86-99). Springer International Publishing. doi:10.1007/978-3-319-43597-8_7

Buchalcevova, A., & Gala, L. (2013). Green ICT drivers and inhibitors perceived by the Czech SMEs. *Journal of Systems Integration*, *4*(2), 43.

Chou, D. C., & Chou, A. Y. (2012). Awareness of Green IT and its value model. *Computer Standards & Interfaces*, *34*(5), 447–451. doi:10.1016/j.csi.2012.03.001

Chow, W., Chen, Y. (2009). Intended belief and actual behaviour in green computing in Hong Kong. *J. Comput. Inf. Syst.*, *50*, 136-141.

Chuang, S. P., & Huang, S. J. (2016). The effect of environmental corporate social responsibility on environmental performance and business competitiveness: The mediation of green information technology capital. *Journal of Business Ethics*.

Chugh, R., Wibowo, S., & Grandhi, S. (2016). Environmentally sustainable Information and Communication Technology usage: Awareness and practices of Indian Information and Communication Technology professionals. *Journal of Cleaner Production*, *131*, 435–446. doi:10.1016/j.jclepro.2016.05.004

Cuerva, M. C., Triguero-Cano, Á., & Córcoles, D. (2014). Drivers of green and non-green innovation: Empirical evidence in Low-Tech SMEs. *Journal of Cleaner Production*, *68*, 104–113. doi:10.1016/j.jclepro.2013.10.049

Deloitte (2015). Competitiveness: Sustainable and Inclusive Growth – The Philippines. Retrieved from http://www.iberglobal.com/files/2016/filipinas_economia_deloitte.pdf

Deng, Q., & Ji, S. (2015). Organizational Green IT Adoption: Concept and Evidence. *Sustainability*, *7*(12), 16737–16755. doi:10.3390/su71215843

Department of Information and Communications Technology. (2016). Philippine Information Technology and Business Process Management (IT-BPM) Road Map. Retrieved from http://www.dict.gov.ph/wp-content/uploads/2014/06/road_map_brochure.pdf

Department of Information and Communications Technology. (2017). 2012-2016 Philippine IT-BPM Road Map. Retrieved from http://www.dict.gov.ph/2012-2016-philippine-it-bpm-road-map/

Department of Science and Technology. (2013). Harmonized National R&D Agenda 2013-2020. Retrieved from http://www.dost.gov.ph/phocadownload/Downloads/Journals/Harmonized%20National%20R%20D%20Agenda%202013-2020.pdf

Department of Trade and Industry (DTI). (2017). Greening the Industry Roadmap. Retrieved from: http://www.dti.gov.ph/programs-projects/faps/greening-the-industry-roadmap

El Idrissi, S. C., & Corbett, J. (2016). Green IS research: A modernity perspective. *Communications of the Association for Information Systems*, *38*(30), 596–623.

Errighi, L., Bodwell, C., & Khatiwada, S. (2016). *Business process outsourcing in the Philippines: challenges for decent work (No. 994945093202676)*. International Labour Organization.

Gan, P. L., Mahmud, I., Ramayah, T., & Zuhora, F. T. (2017). Understanding Attitude towards Green IT among Professionals in IT Service SMEs in Bangladesh. In Handbook of Research on Small and Medium Enterprises in Developing Countries (pp. 48–66). Hershey, PA: IGI Global. doi:10.4018/978-1-5225-2165-5.ch003

Gelenbe, E., & Caseau, Y. (2015). The impact of information technology on energy consumption and carbon emissions. *Ubiquity*, *2015*(June), 1–15. doi:10.1145/2755977

Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, *50*(7), 431–438. doi:10.1016/j.im.2013.01.004

Guerci, M., & Pedrini, M. (2014). The consensus between Italian HR and sustainability managers on HR management for sustainability-driven change–towards a 'strong' HR management system. *International Journal of Human Resource Management*, *25*(13), 1787–1814. doi:10.1080/09585192.2013.860388

Gullo, K., & Haygood, L. (2010). *The Business Case for Environmental and Sustainability Employee Education*. National Environmental Education Foundation.

Harmon, R., & Auseklis, N. 2009. Sustainable IT services: assessing the impact of green computing practices. In *Proceedings of PICMET 2009 PICMET/IEEE*, Portland, Oregon (pp. 1707-1717). doi:10.1109/PICMET.2009.5261969

Hernandez, A. A., & Ona, S. E. (2015). A Qualitative Study of Green IT Adoption within the Philippines Business Process Outsourcing Industry: A Multi-Theory Perspective. *International Journal of Enterprise Information Systems*, *11*(4), 28–62. doi:10.4018/IJEIS.2015100102

Hernandez, A. A., & Ona, S. E. (2015). A Qualitative Study of Green IT Adoption within the Philippines Business Process Outsourcing Industry: A Multi-Theory Perspective. *International Journal of Enterprise Information Systems*, *11*(4), 28–62. doi:10.4018/IJEIS.2015100102

Hernandez, A. A., & Ona, S. E. (2016). Green IT Adoption: Lessons from the Philippines Business Process Outsourcing Industry. *International Journal of Social Ecology and Sustainable Development*, *7*(1), 1–34. doi:10.4018/IJSESD.2016010101

Hilty, L. M., & Aebischer, B. (2015). Ict for sustainability: An emerging research field. In *ICT Innovations for Sustainability* (pp. 3–36). Springer International Publishing. doi:10.1007/978-3-319-09228-7_1

Holden, W., Nadeau, K., & Porio, E. (2017). The Philippines: Understanding the Economic and Ecological Crisis. In Ecological Liberation Theology (pp. 5-9). Springer International Publishing.

IBPAP. (2016). Investor Primer. Retrieved from http://www.ibpap.org/publications-and-press-statements/research-initiatives/investorprimer201

IBPAP. (2016). Philippines: Future Ready. Retrieved from http://www.ibpap.org/publications-and-press-statements/research-initiatives/philippines-future-ready

Jenkin, T. A., Webster, J., & McShane, L. (2011). An agenda for 'Green' information technology and systems research. *Information and Organization*, *21*(1), 17–40. doi:10.1016/j.infoandorg.2010.09.003

Kanemoto, K., Moran, D., & Hertwich, E. G. (2016). Mapping the carbon footprint of nations. *Environmental Science & Technology*, *50*(19), 10512–10517. doi:10.1021/acs.est.6b03227 PMID:27587304

Khan, S. A. R., Zaman, K., & Zhang, Y. (2016). The relationship between energy-resource depletion, climate change, health resources and the environmental Kuznets curve: Evidence from the panel of selected developed countries. *Renewable & Sustainable Energy Reviews*, *62*, 468–477. doi:10.1016/j.rser.2016.04.061

Khor, K. S., Thurasamy, R., Ahmad, N. H., Halim, H. A., & May-Chiun, L. (2015). Bridging the Gap of Green IT/IS and Sustainable Consumption. *Global Business Review*, *16*(4), 571–593. doi:10.1177/0972150915581101

Komatsuzaki, T. (2016). Improving Public Infrastructure in the Philippines. Retrieved from https://www.imf.org/external/pubs/ft/wp/2016/wp1639.pdf

Lee, S. M., Park, S. H., & Trimi, S. (2013). Greening with IT: Practices of leading countries and strategies of followers. *Management Decision*, *51*(3), 629–642. doi:10.1108/00251741311309698

Li, J., He, X., & Zeng, X. (2017). Designing and examining e-waste recycling process: Methodology and case studies. *Environmental Technology*, *38*(6), 652–660. doi:10.1080/09593330.2016.1207711 PMID:27367434

Lim, J. H., Stratopoulos, T. C., & Wirjanto, T. S. (2013). Sustainability of a firm's reputation for information technology capability: The role of senior IT executives. *Journal of Management Information Systems*, *30*(1), 57–96. doi:10.2753/MIS0742-1222300102

Lim, L. B., Pua, G. S., Teoh, P. G., Ng, Y. C., & Sim, J. J. (2015). Modelling green IT adoption among SME. *International Journal of Modelling in Operations Management*, *5*(2), 134–153. doi:10.1504/IJMOM.2015.072673

Loeser, F., Recker, J., Brocke, J. V., Molla, A., & Zarnekow, R. (2017). How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives. *Information Systems Journal*, *27*(4), 503–553. doi:10.1111/isj.12136

Loeser, F., Recker, J., Brocke, J. V., Molla, A., & Zarnekow, R. (2017). How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives. *Information Systems Journal*, *27*(4), 503–553. doi:10.1111/isj.12136

Luthra, S., Garg, D., & Haleem, A. (2014). Green supply chain management: Implementation and performance–a literature review and some issues. *Journal of Advances in Management Research*, *11*(1), 20–46. doi:10.1108/JAMR-07-2012-0027

Magkilat, B. (2015). 1.2 million BPO workers seen by December 2015. *Manila Bulletin*. Retrieved February 2, 2016 from http://www.mb.com.ph/1-2-million-bpoworkers-seen-by-december-2015/

Makela, T., Luukkainen, S., 2013. Incentives to apply green cloud computing. *J. Theor. Appl. Elect. Comm. Res.*, 8, 74e86.

Manning, S., Larsen, M. M., & Kannothra, C. G. (2016). *Global Sourcing of Business Processes: History*. Effects, and Future Trends.

Mariani, M., & Imam, K. (2012). A Preliminary Study of Green IT Readiness in Indonesia Organizations. *Journal of Energy Technologies and Policy*, *2*(5), 1–9.

Mithas, S., Khuntia, J., & Roy, P. K. (2010, December). Green Information Technology, Energy Efficiency, and Profits: Evidence from an Emerging Economy. In ICIS (p. 11).

Molla, A., Abareshi, A., & Cooper, V. (2014). Green IT beliefs and pro-environmental IT practices among IT professionals. *Information Technology & People*, *27*(2), 129–154. doi:10.1108/ITP-10-2012-0109

Montabon, F., Pagell, M., & Wu, Z. (2016). Making sustainability sustainable. *The Journal of Supply Chain Management*, *52*(2), 11–27. doi:10.1111/jscm.12103

Murugesan, S., & Gangadharan, G. R. (2012). Green IT: an overview. In Harnessing Green It: Principles and Practices.

Murugesan, S., & Gangadharan, G. R. (2012). *Harnessing green IT: Principles and practices*. Wiley Publishing. doi:10.1002/9781118305393

Nulty, D. D. (2008). The adequacy of response rates to online and paper surveys: What can be done? *Assessment & Evaluation in Higher Education*, *33*(3), 301–314. doi:10.1080/02602930701293231

Robbins, S. P., Judge, T. A., Millett, B., & Boyle, M. (2014). *Organisational Behaviour*. Australia: Pearson Education, Inc.

Roumasset, J., Ravago, M., Jandoc, K., & Arellano, C. (2016). *Filipino 2040 Environmental Resources, Shocks, and National Well-Being* (No. 2016-3).

Roxas, F., & Santiago, A. (2016). Alternative framework for renewable energy planning in the Philippines. *Renewable & Sustainable Energy Reviews*, *59*, 1396–1404. doi:10.1016/j.rser.2016.01.084

Santiago, E. (2013). The Philippine ICT – The Green IT. Retrieved from http://home.jeita.or.jp/greenit-pc/activity/asia/file/THE%20PHILIPPINE%20ICT%20THE%20GREEN%20IT.pdf

Stankeviciute, Z., & Savaneviciene, A. (2014). Sustainability as a concept for human resource management. *Economics and Management*, *18*(4), 837–846. doi:10.5755/j01.em.18.4.5631

Terazono, A., Oguchi, M., Yoshida, A., Medina, R. P., & Ballesteros, F. C. Jr. (2017). Material Recovery and Environmental Impact by Informal E-Waste Recycling Site in the Philippines. In *Sustainability Through Innovation in Product Life Cycle Design* (pp. 197–213). Springer Singapore. doi:10.1007/978-981-10-0471-1_14

Tseng, M. L., Tan, R. R., & Siriban-Manalang, A. B. (2013). Sustainable consumption and production for Asia: Sustainability through green design and practice. *Journal of Cleaner Production*, *40*, 1–5. doi:10.1016/j.jclepro.2012.07.015

Watling, A., & Zhou, E. (2011). Attitudes Towards Sustainability: A quantitative study of Sustainable Ålidhem.

Weng, M. H., & Lin, C. Y. (2011). Determinants of green innovation adoption for small and medium-size enterprises (SMES). *African Journal of Business Management*, *5*(22), 9154.

Yang, Z., Sun, J., Zhang, Y., Wang, Y., & Cao, L. (2017, January). Employees' Collaborative Use of Green Information Systems. In *Proceedings of the 50th Hawaii International Conference on System Sciences*. doi:10.24251/HICSS.2017.076

Yoshida, A., Terazono, A., Ballesteros, F. C. Jr, Nguyen, D. Q., Sukandar, S., Kojima, M., & Sakata, S. (2016). E-waste recycling processes in Indonesia, the Philippines, and Vietnam: A case study of cathode ray tube TVs and monitors. *Resources, Conservation and Recycling*, *106*, 48–58. doi:10.1016/j.resconrec.2015.10.020

Zailani, S., Iranmanesh, M., Nikbin, D., & Jumadi, H. B. (2014). Determinants and environmental outcome of green technology innovation adoption in the transportation industry in Malaysia. *Asian Journal of Technology Innovation*, *22*(2), 286–301. doi:10.1080/19761597.2014.973167

Zaman, B., & Sedera, D. (2016). Green Information Technology as Administrative innovation-Organizational factors for successful implementation: Literature Review. arXiv:1606.03503

Alexander A. Hernandez is Associate Professor at the Technological Institute of the Philippines. He holds a Doctor in Information Technology from the De La Salle University. His research interests include data mining, enterprise and decision support systems, sustainability and green computing. He has published papers in academic journals and conferences, including the International Journal of Enterprise Information Systems, Journal of Case on Information Technology, International Journal of Social Ecology and Sustainable Development, International Journal of Green Computing, International Journal of Sociotechnology and Knowledge Development, among others.