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A Contextualist Analysis of Green IT Learning in Organisations

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Abstract

IT organisations are increasingly called on to contribute to organisational goals for environmental sustainability. To do so, they first need to be aware of why they should “Green IT” as well as understand what it is they need to know and how they can embed this knowledge throughout the organisation. This paper reports a contextualist analysis of six case studies to unravel the why, what and how of Green IT learning. Findings indicate that the multi-disciplinary nature of Green IT necessitates access to a wide-range of knowledge sources, top-down and bottom-up approaches to learning and the creation of space for a Green IT dialogue. The use of crowd sourcing and innovation farming to integrate individual learning to the group and organisational levels was also evident.

Keywords

Green IT, Green IT learning, contextualist framework.

1. Introduction

Demands from environmental groups, governments and consumers to address environmental sustainability concerns are important to organisations as such issues are increasingly thought to affect competitiveness (Rao & Holt, 2005). As Information Technology (IT) plays an integral role in business activities, it ensues that environmental sustainability concerns should be extended to IT. Green IT is “a systematic application of ecological-sustainability criteria (such as pollution prevention, product stewardship, use of clean technologies) to the creation, sourcing, use and disposal of the IT technical infrastructure as well as within the IT human and managerial practices” (Molla et. al., 2011, p. 73). Currently it is primarily pioneering organisations that are focusing on Green IT, however, such initiatives will eventually become a mainstream and core business practice (Mines & Davis, 2007).

In order for Green IT to become core business practice, it is important to identify why organisations are driven to learn to Green their IT, what it is they need to know, and how they can embed this knowledge throughout the organisation. Although there are a few studies that investigate environmental sustainability from the organisational learning perspective (e.g. von Malmborg, 2002), reviews of the information systems literature show that there is virtually no research that examines, how the IT industry and IT departments learn to develop their Green IT (Elliot, 2011; Melville, 2010; Watson et. al.’s, 2010). To address this, this paper adopts contextualist and process framework to identify the “why”, “what”, and “how” of Green IT learning in organisations.

The paper is organised as follows. First, discussion of a contextualist framework is provided in the context of Green IT learning. Second the research method is described. Third, findings from cases studies of six organisations are summarised and key findings are then discussed. Finally conclusions are drawn, limitations of the study and possibilities of future research are presented.

2. Analytical Framework

Effectively embedding and managing the principles and practices of environmental sustainability into organisations require changes in the strategy, process, people and technology aspects of organisations (Post & Altman, 1994; von Malmborg, 2002). To introduce such changes, organisational learning is critical (Jacobsen & Thorsvik in von Malmborg, 2002). Likewise, Green IT learning is essential as organisations strive to embed sustainability in IT managerial practices, IT people mindset, IT processes and IT infrastructure. Such learning can be seen within the wider context of organisational change and a relevant organisation change theory can be used as an analytical framework to unravel the what, how and why of Green IT Learning. Particularly, Pettigrew's (1990) contextualist and processual theory, which has been applied in information systems evaluation (Stockdale and Standing, 2006), of organisation change is relevant for this purpose and focuses on the what, why and how of change. The 'what' of change refers to the content and focuses on the subject of change and the recipient of the discrete set of actions. The 'why' of change can be derived from the analysis of the inner and outer context and refers to the motivation and drivers. The 'how' of change can be understood from the process of change and the analysis of sequence of events that lead to change. Using the contextualist framework, which is also referred as the context, content and process (The CCP) perspective (Stockdale and Standing, 2006) as analytical lens, a brief review of the literature on the context, content and process of Green IT learning is presented below.

2.1 The Context of Green IT Learning

The context issues of Green IT learning focuses on drivers and motivations of Green IT. These could be either internal or external to an organisation (Molla 2009). Internally, organisations' pursuit of ecological sustainability goals of eco-efficiency, eco-effectiveness and eco-equity (Chen, Boudreau & Watson 2008) can be translated into the IT domain and create the need for IT departments to learn how to support the implementation of these goals within the IT department as well as the wider enterprise. For instance, the data centre operation that provides basic connectivity, transaction processing and information management functions in many organisations is an energy intensive operation where IT resources are often underutilised leading to energy wastage (Daim et al. 2009). Thus, improving the cost, resource allocation and energy consumption of data centres is becoming important and can drive IT infrastructure managers and personnel to develop their Green IT know-how. Corbett's (2010) analysis of articles published in *CIO Magazine* shows that economic benefits, particularly cost savings, were the most commonly cited driver for Green IT. As companies strive to transit to an increasingly carbon-constrained market and look into new sources of competitiveness through environmental innovation, differentiation and/or cost leadership (Orsato 2006), IT leaders are called upon to contribute to strategising business solutions that reduce environmental impact (Esty & Winston 2006). Further, executive leaders' expectation of the implementation of green strategies and policies throughout an organisation can create the internal motivation to learn about Green IT (Olson 2008).

Externally, national and international regulators and the global IT industry's realisation of the environmental externalities associated with IT in terms of energy consumption, electronic waste and emissions (Köhler & Erdmann 2004; Murugesan 2008) create the coercive and normative institutional pressures that can influence many IT organisations to develop their know-how and skills to respond to those pressures. Since 2007, major IT research and consulting firms such as Gartner, IBM, Deloitte, and Accenture are actively setting the agenda and publishing relevant material for Green IT (Gartner 2008). These institutions and their Green IT activities bring Green IT as an important and relevant IT management issue and trigger individual and organisational learning to understand, apply and excel in it. Further, a number of IT vendors are marketing their

products as green solutions. Indeed, IT vendors have been at the forefront of setting the Green IT agenda (Murugesan 2008). National, professional and inter-governmental institutions often wield a great deal of influential power in relation to professional practice, which in turn, can have implications for learning and adopting Green IT (Molla & Abareshi 2011). Regulatory requirements play significant roles in influencing the implementation of green practice in the IT lifecycle (Murugesan 2008) and in creating the need for systematically analysing, interpreting and integrating the impact of new and existing regulations on IT operations (Butler 2011).

On the basis of the above, the context of Green IT learning can include an organisation's economic expectation of enhancing the efficient utilization of IT and IT enabling resources, a regulatory response of ensuring and a normative objective of attaining legitimacy (Molla 2009; Molla & Abareshi 2011).

2.2 The Content of Green IT Learning

Content refers to what organisations need to learn to embed sustainability in IT. Although there are a number of sustainability oriented degree programs and professional trainings in business management and environmental schools (Watson, Boudreau & Chen 2010), a matured definition and identification of the Green IT body of knowledge has yet to emerge (Sendall et al. 2010). Watson et al. (Watson, Boudreau & Chen 2010) suggest that information systems graduates should learn about green information systems and suggest a number of topical areas. Likewise, Sendall et al.'s (2010) survey of curriculums found a number of Green IT topics that are being taught in higher education institutions including data centre energy consumption, server virtualization and consolidation, energy management systems; recyclability, paper waste, budget management and sustainability principles.

Professional IT organisations such as the Australian Computer Society (ACS) through the “core body of knowledge” (CBOK) and skills frameworks such as those encompassed in the Skills Framework for the Information Age (SFIA), offer guidelines that indicate what IT professionals need to understand and what abilities and skills they require with respect to Green IT. For instance, the SFIA 4G includes four new skills for sustainability (see Table 1). In addition, commercial training institutions and ICT professional bodies offer training courses and certifications which can provide insight as to what IT professionals should know about Green IT. These tend to be aligned with SFIA and cover topics such as sustainability strategy, management and assessment; regulations, standards and industry best practice; technical tools and methods such as grid computing, telecommuting, virtualisation and energy management; sustainability practices across the IT supply chain from sourcing to end-of-life; and business issues such as leadership, knowledge and change management (Worthington, 2011).

Skill	Summary Content of Skills Framework Information Age (SFIA)
Sustainability Strategy	The preparation of a sustainability strategy for IT, which aligns with established corporate strategy and as appropriate, political, legislative, economic, social and technological factors.
Sustainability Management	Specification, planning and management of sustainability-based changes to the IT infrastructure in the context of company strategy and policy, and regulatory and contractual obligations. Evaluation to ensure that planned benefits are achieved.
Sustainability Assessment	Evaluation and assessment of operational and planned IT services, devices and day-to-day operations such as travel. Track changes; identify areas for improvement; and initiate change.
Sustainability Engineering	Application of appropriate methods to assure sustainability in all phases of the life cycle of energy- or materials-consuming systems and services, including maintenance and re-use.

Table 1: The Content of Green IT Learning: Skills Framework for the Information Age (SFIA)
(Source: <http://www.sfia.org.uk/>)

Thus the content of Green IT learning is broad and ranges from understanding basic climate change and organisational sustainability strategy to having the technical ability and skill to assess, develop and evaluate IT and information systems solutions and practices that are both economically viable as well as environmentally sustainable.

2.3 The Process of Green IT Learning

The process of Green IT learning focuses on how organisations can initiate, undertake and implement Green IT learning. There are many theoretical positions and conceptual models of organisational learning that are potentially useful for understanding how organisations learn to Green IT. For example, the seminal “4I framework” of organisational learning proposed by Crossan et al. (Crossan, Lane & White 1999) considers organisational learning as a dynamic and ongoing process. The 4I framework implies that Green IT learning can occur at the individual, group and organisational levels and that these three levels of learning occur across the four social and psychological processes of intuiting, interpreting, integrating and institutionalising. Intuiting occurs at the individual level and comprises IT people’s recognition of the importance and relevance of Green IT to their career, professional experience, their organisation and to society (Crossan, Lane & White 1999, p. 525). Interpreting occurs at the individual and group levels and encompasses when IT people start to voice their environmental concerns related to IT to others. Integrating occurs at the group and organisational levels and is “the process of developing shared understanding among individuals and of taking coordinated action through mutual adjustment” (ibid, p. 525). Institutionalisation occurs at the organisational level and is “the process of embedding [Green IT] learning that has occurred by individuals and groups into the organisation and it includes systems structures, procedures and strategy” (ibid, p. 525).

The contextualist framework has informed our enquiry into the understanding of Green IT learning in organisations. The three intertwined aspects of the framework will be used to unravel why, what and how Green IT learning could be initiated and executed. To this end, the concepts identified in the context, content and process of learning will be used as preliminary scaffolds and initial templates to guide data analysis. The following section discusses the research method followed.

3. Research Methods

As an in-depth understanding of the phenomenon, including contextual issues from the stakeholders’ point of view were required an interpretive approach was adopted. Six case studies were undertaken (Yin, 2003). A multi-case study approach is appropriate when cases might be different in ways that are key to a study and can therefore be compared, resulting in the development of a theory or proposed generalisation (Leedy & Ormond, 2001). The case organisations were selected to provide a mix of small and large companies and of IT vendors and IT using organisations (see Table 2).

Three of the case studies were conducted with IT vendors and the other three were undertaken with organisations implementing Green IT initiatives internally. The cases were selected to get insights on their Green IT learning process and the factors that influenced their journey and highlight issues that are both unique and shared amongst IT service and product providers and customers. Semi-structured interviews were conducted with 11 managers (two informants per case excepting one case) (see Table 2). The interviews explored Green IT implementations, processes and influential factors of Green IT learning in each organisations. Pre-interview documentation outlining the concepts of Green IT and Green IT learning in organisations was provided. In order to ensure that important issues were not ignored, the conduct of the interview followed an open interview style. Interviews were between 60-90 minutes duration.

All interviews were recorded via audiotape, transcribed and analysed using directed qualitative content analysis (Mayring 2000). The concepts developed in the analytical framework section were used to guide the coding process.

4. Findings

Table 3 summarizes the key findings that emerged from the analysis.

5. Discussion

This section highlights the key findings regarding the context (5.1), content (5.2) and process (5.3-5.5) of Green IT learning.

Industry /line of business	Size	Participants	Description
Green IT Consulting	Small	CEO Research Director	Provides sustainability consulting in Green IT and carbon compliance.
IT Solution Provider	Small	CEO Operations Manager	Developed online carbon management system.
Green IT Consulting	Small	Education Consultant	Designed and delivers Green IT course.
Legal Firm	Large	“Carbon Neutral Project” Manager CIO	International firm with offices throughout Australia and Asia, specialising in commercial and environmental law.
IT Firm	Large	Data Centre Manager Sustainability Strategy Manager	Provides IT hardware, software and services.
University	Large	CIO Data Centre Manager	Focuses on practical education outcomes and applied, outcome-oriented research.

Table 2: Summary of Case Organisations and Participants

5.1 Eco-goals, Employee-interest and Regulations Motivate Green IT Learning

Green IT learning is driven by a combination of internal and external factors as well as individual and organisational initiatives. Of the three eco-goals (Chen et al. 2008), *eco-efficiency* was a common driver for Green IT learning in all cases. In client firms, energy cost reduction was utmost importance where as in provider firms in addition to cost reduction, the need to open new revenue lines, be competitive and offer new and innovative technology-based solutions have motivated Green IT learning. For example, the IT firm noted that their investment in state-of-the-art technology to ensure optimal environmental performance of data centers, particularly in terms of efficient use of electricity, was a means to obtain a competitive advantage. Similarly, the university noted that the drive for operational efficiency was often compatible with Green solutions.

Eco-effectiveness was mainly observed in larger organisations that have corporate level sustainability strategy and commitment that is being translated to the area of IT. These organisations have committed to corporate social and environmental responsibility. For example, the large IT firm’s sustainability vision requires a fundamental redesign of IT operations to address environmental issues. As a result it is investing significantly in research and development in electronics and this was seen to have the potential to produce important eco-effective outcomes. In the legal firm, although a few individuals set the initial agenda for learning, the establishment of national footprint secretariat and committee has made Green IT to feature in the company’s strategic plan which led to local footprint committee.

While eco-goals motivate learning at the organisational level, the cases indicate that employees’ environmental altruism and green career prospectus were important motivators at individual level. For example, the legal firm had noticed that so-called “Generation Y” employees were particularly interested in sustainability. This finding is consistent with Nunn (Nunn 2007) who claims that “more than 70% of MBA students from top schools are willing to accept a 10 to 20 percent lower salary to work for a responsible company”.

	Green IT Consultant	Green IT Vendor	Green IT Educator	Legal Firm	IT firm	University
Context	Revenue stream; Energy cost; Background in IT & sustainability; Good corporate citizenship; Legislation.	Revenue stream; Cost savings; Senior management epiphany & employee career aspirations; Carbon policy; Penalty of non-compliance.	Regulation; Corporate policy/strategy; Individual interest.	Cost savings; Resource (paper, energy) efficiency; Client push; Strategic plan; Employee ‘passion’ & commitment.	Corporate philosophy, vision and strategy for environmental differentiation and leadership; Green branding; Customer demand for sustainable, cost efficient solutions.	Energy efficiency; Compliance with “standards”; Staff awareness; Green compatible with standard operating environment; Environmental stewardship.
Content	Green IT attitude, policy, practice, governance & technology; End-user life cycle; Enabling role of ICT; Reduction of ICT emission; Benchmarking & capability assessment.	Technical skills; Environmental issues & implications for IT; Green product development; Footprint; Embed sustainability in firm; Energy efficiency; Virtualisation & consolidation; Connecting finance & sustainability.	Politics, science & business of sustainability; Business/IS strategy & planning; Technical strategy & planning; Procurement.	Measure & reduce (energy, paper cost); Carbon footprint audit; Strategic alignment; Virtualising technology; Sustainability measurement & reporting; Project management; Cost/benefit analysis of Green; Sustainability procurement.	Sustainable customer solutions; Legislation; Design, build & manage ‘realistically green’ datacentres; Green IT idea generation; Embed sustainability in IT architecture; Market trends and experience of companies; R&D; IT & firm footprint; Strategy, planning & alignment; Quick wins; Electricity consumption; How IT enables sustainability.	Measure energy consumption; Recycling & PC end-of-life; Cooling issues of datacenters.
Process	Reading; “Immerse yourself”; Informal networking (e.g. IT companies); Build and use previous experience.	Exposure to sales people, trade exhibitions, seminars; Access books, wikis, blogs, newsletters; Training; After-sales support from vendors; Personal attitude & decisions.	Formal courses; Social processes (e.g. class discussion); e-learning important; Reflective practice.	Publicize success (newsletter); Green IT innovation, idea farming, incubation & crowd-sourcing; Measurement of consumption (energy, paper); Online resources; Market & industry research; Space for green conversations (e.g. breakfast session); Governance structure; Budget for Green IT; Champions; Grass roots approach; Involve staff at all levels; Learn from vendors; Training; Energy as KPI of IT projects.	Employee engagement campaign (e.g. Green IT week); Green IT innovation farming, innovation incubation & crowd-sourcing; Idea channeling from concept to budget to product; R&D; Training (e.g. induction); Green IT policy & governance structure; KPIs for sustainability; Market reports; Open communication channel; Sustainability portal; Space for sustainability conversation; Champions; Consultants.	Sustainability committee; KPIs for energy & consumption; Management reporting; Industry collaboration; Top down: CIO->IT staff; Attendance at conferences; Monitoring market to identify “best practice.

Table 3: Summary of Contextualist Analysis:

Government policy and legislation were also identified as one of the external triggers to Green IT learning. Interviewees believed that many organisations will not develop Green policies and associated governance mechanisms, nor provide appropriate resources, without environmental legislation. Further, demand for Green IT skilled IT professional is likely to increase, when environmental legislative requirements increase and organisations strive to respond to those requirements.

5.2 Green IT Learning is Multi-faceted and Contingent

The Green IT domain was identified as multi-disciplinary, requiring IT people to understand a wide range of complex issues. It is also contingent upon the size, industry, IT intensity and IT sourcing governance aspect of organisations. Generally, the SFIA framework was found to be relevant to capture the (“what”) knowledge, skills and ability that organisations of Green IT learning.

Green IT learning starts with understanding what the topic actually means and the underlying issues. Know-how and ability to develop Green IT strategy that is aligned with business and sustainability strategies is important for larger organisations. This reinforces Ereik et al. (Ereik et al. 2011) who found lack of consistent approach for aligning Green IT with corporate business and sustainability goals. Green IT strategy provides an important indication as to what areas ICT professionals should operationalise and can be used as the basis for policies and planning of key practices to be adopted. Strategy development requires understanding the consumption and sources of supply of energy and materials along with legislative, economic, social and technological issues.

The ability to plan and manage Green IT via formal governance mechanisms was seen as particularly important by large organisations but was not as prevalent in smaller organisations that claimed that informal approaches were more practical in the “micro” context. Both the legal and IT firm had employed consultants to benchmark their Green IT performance. A common component of sustainability management learning in large organisations is developing their skills and ability for undertaking IT footprint analysis and benchmarking activities whereby the resulting evaluation information informs future planning and management of Green IT initiatives.

Organisations also wished to demonstrate the result of Green IT initiatives to justify future investments and identify areas for improvement. They therefore sought knowledge on how to measure and monitor sustainability at an operational level including energy consumption and paper use. For example, the legal firm focused on learning to measure resource consumption which translated into IT resources such as energy, paper, e-waste and IT vendors’ sustainability performance. How to embed sustainability taking a lifecycle approach in the design and delivery of the ICT infrastructure was a common area of learning for all organisations. In particular, the technical aspects of Green IT learning focused on server virtualization and consolidation and data centre design and management. Further, understanding existing and upcoming legislations on energy and greenhouse gas emissions and their IT implication was identified a common area of learning.

5.3 Sources, Mechanisms and Enablers of Green IT learning

Because the content of Green IT is multi-disciplinary and covers topics that cut across the business, sustainability, supply-chain and ICT domains, it necessitates knowledge acquisition from a wide-range of external stakeholders, forums and reference materials. In fact the ability to source relevant information in a timely manner is one of the critical success factors in dealing with emerging information technology (Cegielski, Reithel & Rebman 2005). All organisations identified that they acquire new knowledge on Green IT from a wide-range of sources. These include:

- Inter-organisational relationships with customers, suppliers, partners and competitors;
- Conferences on sustainability and Green IT;
- Desk-based research such as identifying reference material, blogs and white papers via the Internet;
- Subscriptions to research and consulting firms;
- Green IT training courses; and
- Participation in Green IT networks.

Green IT learning mechanisms comprised both top down and bottom up approaches. In terms of top down approaches, a clear vision from senior management was considered important in larger organisations. Such vision facilitated the development of clear Green IT policy and governance mechanisms to ensure the combination of new and existing Green IT knowledge, at an individual, group and organisational level. Organisations believed that many IT staff would disregard organisational objectives for eco-sustainability if they were not measured on this performance. Thus the setting of environmental targets via key performance indicators (KPIs) for individual employees was seen as particularly important to cultivate employee intuition and learning interpretation. The use of workplace relevant assessment tasks was a powerful means to increase the likelihood that knowledge acquired from external sources is embedded into the IT organisation. Mentoring is another mechanism to transfer knowledge acquired through formal training amongst members of the IT organisation. For example, once the IT vendor had initially trained representatives of the IT organisation on the use of their product, these employees were typically charged with training others. Such transfer is an example of learning transfer from individuals to groups.

In terms of enablers of learning collaborative IT tools such as intranet, portal, Web 2.0 type of technologies play significant roles. In addition, effective leadership and clarity around the responsibility for Green IT is central to the exploitation process and ultimately, developing mature Green IT practices and technology infrastructures.

5.4 Crowd Sourcing and Green IT Innovation Farming

To source new ideas for Green IT initiatives and integrate individual level learning to group and organisational level learning, the use of crowd sourcing was evident. For example, the IT firm participates annually in “Green IT Week” where employees throughout the organisation are asked to generate and share ideas for Green IT via the organisation’s portal utilising social media and collaborative space. The legal firm uses a similar method and the most innovative idea received is awarded with a highly coveted prize during Earth Hour. Having sourced the ideas, the organisations then discuss these in formal committees and for potential incorporation into the formal strategic planning and budgeting process for implementation. The organisations report that this approach has beneficial outcomes not only in terms of Green IT initiatives, but also in cultivating a positive organisational culture.

5.5 Space for Green IT Conversations and Dialog

All organisations noted the importance of formal and informal communities in the Green IT learning process. The IT firm and legal firm both had informal Green IT communities, which over time became formalised. In terms of acquiring knowledge from other departments within the organisation, interaction between the IT department and the sustainability department (or equivalent) was important. Ensuring that IT staff were members of wider sustainability communities was seen as important, as such communities were a source of

potential “champions” of Green IT initiatives. These communities create the space for Green IT conversations to take place and facilitate the institutionalisation of Green IT Learning.

6. Implications and Conclusion

Calls for IT organisations to increase their efforts towards sustainability increasingly appear in the literature. However, in order for IT organisations to answer this call they must be aware of *why* they should Green IT as well as understand *what* it is they need to know and *how* they can embed this knowledge throughout the organisation. To this end, six case studies were analysed through the lens of the contextualist framework. This has several theoretical and practical implications.

Theoretically, this paper contributes to the Green IT literature. It extends previous research on several dimensions. Firstly, the paper introduces an original learning perspective to Green IT literature. The majority of previous studies approached Green IT from a technology adoption and implementation perspective. However, the focus of the study was on understanding the context, content and process aspects of Green IT learning rather than proving it. Secondly, it utilises a theoretical framework that so far has not been applied to Green IT research. The contextualist analysis presented allows a holistic assessment of Green IT learning and the paper transferred knowledge from organisational change and learning to Green IT. As such, the paper demonstrates the utility of the contextualist framework to future Green IT research and offers the first evidence and experience base that future research can add to, in the applicability of the framework. These results extend the application of the context, content and process (CCP) perspective of information systems evaluation (Stockdale and Standing, 2006), to green IT learning. The framework provides a holistic perspective for understanding green IT learning with sufficient flexibility to accommodate future changes in the context, content and processes of green IT. Thirdly, the study provides anecdotal evidence of the need for upgrading and updating the knowledge, skills and abilities of IT professional associated with Green IT implementations - an area that has not received rigorous research. Fourthly, the study adds to the works of Watson et al (2010) and Sendall et al (2010) who indicated the need for incorporating sustainability topics into undergraduate and graduate information systems programs.

In terms of practice, the experiences of the cases indicate that while clarity of government regulations that are relevant to IT and IT related resources create the initial motivation for Green IT actions and learning, individual self-interest and Green IT career prospects drive learning at individual level. To facilitate Green IT learning at group and enterprise levels, organisations have to create the space and institutional mechanisms for Green IT conversations to take place. The senior management’s commitment, the involvement of employees, availability, accessibility and economic viability of relevant information and innovative Green IT practices that go beyond quick wins have significant influence on the what, why and how of Green IT Learning. The paper has also implications for information technology certification providers as it gives some indications of what to include as part of Green IT qualifications.

The paper has some limitations. Organisational learning is a means rather than end. Because the objective of the paper was to explore the what, why and how of learning and due to space constraints, the outcome of learning was not covered. Further research can be done to explain the contribution of Green IT learning to improve internal operations as well as obtain market advantages. Another area for future study relates to the methodology. The data collected were based on one-off interviews. A longitudinal study that analyses sequence of events that lead to Green IT learning and outcome would generate a richer understanding. Further, the ability to generalise from the results is limited by the small number of cases and interviews in this

study and it is not the authors' intention to do so. Rather the study represents an exploratory investigation of Green IT learning.

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